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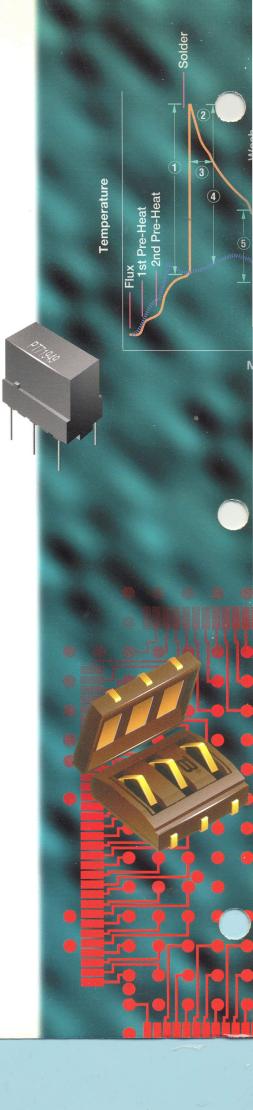


Mission Statement

We will be the preferred strategic link between our suppliers and customers. We will serve today's needs for electronic components, systems, and services – and tomorrow's needs for technology. We will be among the top independent distributors. We will provide our investors with attractive financial growth and our employees with an equal opportunity for personal and professional growth. We take pride in our culture, dedicated to: Integrity, Flexibility, Fairness, Growth, Quality, Success in all regards. We are committed to doing what we say we will do!

CORPORATE HEADQUARTERS

CLEVELAND, OH 4800 East 131st Street Cleveland, OH 44105 TEL: 216-498-6305 FAX: 216-663-1004



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Today, Bourns employees have a mission that is vastly different from the operations and objectives of the past. The speed of new product development has prompted manufacturers to design and produce new products in far less time, at a lower cost, and with higher quality than in the past. We understand the challenges that test today's manufacturer and the ability to participate in a global business environment. We are committed to being part of the successes with new and more efficient products than ever before.

While the industry is changing, we will not

lose sight of the past, and our roots – dating back to Marlan Bourns' invention of

the linear motion potentiometer in 1947 and the trimming potentiometer in 1952. Over the years our business philosophy has earned us a reputation for high-quality resistive components that perform year after year and give buyers peace of mind when choosing Bourns. We appreciate the trust our customers place in us, as we meet the new criteria our industry demands.

New Technologies and Products

This Solutions Guide is growing to meet our customers' requirements. We appreciate the need to reduce the number of suppliers. We,

too, are choosing only our best suppliers to do business with, thereby reducing costs to you, our customer. Consequently, we strive to provide an increasing number

of products that add value to your designs and to the end customer's appreciation of your product.

You will find a new line of products in this edition of the Solutions Guide. Worldwide offering of inductive components,



Meeting the Needs of a New Generation

ASIC encoders, chip resistors, chip arrays, pressure sensors and modular contacts are new additions to our product offering. In the coming months Bourns will continue to offer new products as never before. Therefore, we encourage you to challenge us with your design requirements. We may have a solution on the drawing board to meet your needs. And your innovative application of our new technology may make your "product idea" a "product reality."

Global Manufacturing Centers

To support our customers, we have established a worldwide network of automated high-volume manufacturing facilities. This affords customers the local supply levels they need at their global locations, with the security that they are receiving the same high quality component in China as they are in Ireland, for example. It also allows us to provide 24-hour design services and manufacturing capacities to meet demands in a timely manner.

Bourns operates ten manufacturing centers worldwide. They are located in Riverside, California; Logan, Utah; Ogden, Utah; Tijuana, Mexico; La Mesa, Mexico; Cork, Ireland; Hillend, Scotland; Lin-Kou, Taiwan; Heredia, Costa Rica; and Xiamen, China.

Recon/Optical, Inc., a Bourns subsidiary located in Barrington, Illinois, is a worldwide supplier of imaging and sighting equipment. For more information, call (708) 381-2400.

Insistence on Quality and Continuous Improvement

Bourns has always been committed to producing high-quality products. However, today this commitment is an even bigger focus. Bourns products are now manufactured

throughout the world in ISO 9000 certified facilities. ISO's quality standards are internationally recognized in over 90 countries. Bourns is proud to be one of 4,000 companies in the United States and Canada registered to one of the ISO 9000 standards. Many of our manufacturing centers have achieved ISO 9001 certification, which is the most comprehensive of the ISO standards. This governs the consistency of measurement and independent assessment of our design, development, production and installation of a product to the customer's specification.

In addition, it is our mission to achieve 100% on-time deliveries to our customers. We define this as three days early and zero days late.

Continuous improvement is the vehicle by which we meet our commitments at Bourns. We welcome your comments and suggestions about our business practices and service to our customers. Our mission is to continuously improve our technologies, systems, products and services to maintain a role of industry leadership with the highest level of integrity.

Environmentally Conscious and ODS Free

Bourns strives to be a good corporate citizen and environmentally conscious in every way we can. We have eliminated Ozone Depleting Substances from all of our manufacturing processes and facilities. Our shipping department has changed their packing material to one that is easily biodegradable. Recycling is a regular part of our waste elimination process. Bourns has an extensive rideshare program to reduce air pollution and traffic congestion,

and we are constantly seeking new ways to improve our environment.

Automated Forecast Sharing and EDI

Bourns has implemented a new forecast sharing program in response to our customers' requests. We now have the ability to automatically analyze a customer's product requirements and compare it to our own production schedules to guarantee that we meet production needs. This system has helped customers with improved ordering accuracy, quicker responses, and more time to spend on other issues.

Electronic Data Interchange (EDI) is also a valuable tool for our customers. On average, eighty percent of our new orders are received and processed via EDI with our manufacturer's representative companies, distributors and OEM customers. The system is used for transactions such as invoices, shipping schedules, purchase orders, changes and acknowledgements, and the automated forecast sharing program outlined above. EDI has helped Bourns and its partners achieve significant cycle-time, error-reduction, and transaction improvements.

Welcome to the Bourns Electronic Components Solutions Guide. If you are unable to find a solution to your design problem within these pages, please contact a Bourns representative today.

The Bourns Mission

Bourns serves customers on a global basis with technological products of innovative design, superior quality and exceptional value. We commit ourselves to excellence, to the continuous improvement of our technologies, systems, products and services, to industry leadership and to the highest level of integrity.

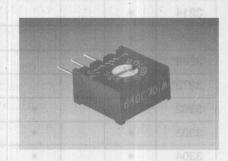
Gordon L. Bourns

Gordon L. Bourns
President



Trimmers 139 town 935tm2

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PRODUCT SELECTION GUIDE TRIMMERS Surface Mount Packages

Model	Elem Techno		Num of Tu			Sealed Open			Siz	ze		Packaging Options	Adjust	Page	
Number	Cermet	W/W	Single	Multi	Sealed	Open	2mm	3mm	4mm	5mm	1/4"	.35"	See Note 1	See Note 2	No.
3214				.50					•		alo	bor	d lanEdgO	T,S	12
3224*	•			•	•			13.1	•				Е	T,S	14
3269* **	•			•	•	Dervice C		FIRE	4- 6	1182	•	EGA GET	G,T	T,S	58
3272* **	•			•00.			and the		- 4-1-2-1	encia	10 ((• D	G,T	S	58
3302	•		•	30		•	•					AT 4	E	Т	27
3303	•		•			•		•					Е	T,B	29
3304	•	Trible.	•	88.					0	rined	mul	he	NII- apea l	.llT	31
3313*	•		•	gor	•			•				GNL o	E de l	T	36
3314	•		•		•				•				E,G,T	T,S	37
3324*	• .		•	\$7.			6	9888	Proc	ening	Sea	bns	Bulleplos	T	42
3325**	•		•	ar	•				de de	nais:	•	Olar	oiteoilae A	T,S	58
3335* **	•		•		•					•			E,G	Т	58
3363**	•		•			•		•					Е	Т	58
3364	•		•			•			•				Е	T,B	49
3373*	•		•					•					Е	Т	52
3374*	•		•		•		TEC		•				Е	Т	53

NOTE 1: Standard packaging; some options may require alternate packaging. Consult factory. T = Tube, B = Bulk, E = Embossed Tape - 7" Reel, G = Embossed Tape - 13" Reel

NOTE 2: T = Top Adjustment, S = Side Adjustment, B = Bottom Adjustment

*Indicates patented models.

^{**} Optional products (not recommended for new designs).



PRODUCT SELECTION GUIDE TRIMMERS

Commercial/Industrial Through-Hole Sealed Packages

Model	Elem		Num of Tu				Size	е			Packaging Options 4" See Note 1	Adjust	Page
Number	Cermet	ww	Single	Multi	1/4" Sq.	5/16" Sq.	3/8" Sq.	1/2"	3/4"	1-1/4"		See Note 2	No.
20**	•			•					20mm		T	S	58
3005**									•		Т	S	58
3006	•										Т	S	9
3009**	•			•					•		T,B	S	58
3057		•		•						•	T,B	S	10
3059		8		•						•	T,B	S	:11
3082**		8		•							Т	S	58
3099**	B.T •	e,r							•		Т	S	58
3250									- 3		T,B	T,S	16
3252	•	1 1		1.		8			1		T,B	T,S	17
3260	retne	0.0	betto	/ Mc	H•m	Curre	wo.fi	tauk	Pror	ecific	atloh Se	T,S	18
3262*	•			•	•	THE REAL PROPERTY.					Т	T,S	19
3266*	•	7 may		•	•					la seri	T	T,S	20
3290		•		•		1307				Latin san	T,B	T,S	21
3292*		T.		•							T,B	T,S	22
3296*	•										T,R	T,S	23
3296-LC2*				•			•				T,B	T,S	24
3296-OT1*		91		•							Т	T,S	25
3299*	•			•			•				T,B	T,S	26
3323**	•		•		•		15.15.			etc	T,B	T,S	58
3329	•		•		•						T,B,R	T,S	44
3339				•		•					T,R	T,S	45
3345**		•	•								В	T,S	58
3362			6								T,R *	T,S	47
3386											T,B,R	T,S	54
3386-HV2	•		•								Т	T,S	56
3386-HV3	•						•				Т	T,S	56
3386-OT1	•		•								T,B	Т	57

NOTE 1: Standard packaging; some options may require alternate packaging. Consult factory. T = Tube, B = Bulk, R = Tape and Reel

NOTE 2: T = Top Adjustment, S = Side Adjustment

*Indicates patented models.

^{**}Optional products (not recommended for new designs).



PRODUCT SELECTION GUIDE TRIMMERS Open Frame Packages

Model	Elen Techn		Num of Tu			Mounting Type		Size					Packaging Options	Adjust	Page
Number	Cermet Carbon Single Multi SMT Leaded	2mm	3mm	4mm	6mm	9mm	3/8"	See Note 1	See Note 2	No.					
3302	•		•									6 162	Е	Т	27
3303	•		•		•			•					Е	T,B	29
3306			•			•				•			В	T,S	33
3309	•		•								•		В	T,S,B	34
3316**		0,1	•			•		HE I			•		В	T,S	58
3318		•	•			•				•			T,B	T,S	39
3319		E.T	•	-		•					• 8		В	T,S,B	40
3352	•	T	•			0. •						•	В	T,S	46
3359/VA05**	•	T	•			•						•	T,B	T,S,B	58
3363**		8.7	•		•			•					E	Т	58
3364		ym (9)	•		•				•				Е	T,B	49

**Europe

Application Specific Products (Low Current, High Voltage, Center Taps)

Model	Eleme		Num of Tu				Size					Adjust	Page
Number	Cermet	WW	Single	Multi	1/4"	5/16"	3/8"	1/2"	3/4"	1-1/4"	See Note 1	See Note 2	No.
3296-LC2*				•			•	Re W			Т	T,S	24
3296-OT1*		ат		•			•				Т	T,S	25
3386-HV2	•		•				•				Т	T,S	56
3386-HV3	•	New P					•				Т	T,S	56
3386-OT1*	•	7					•				T,B	Т	57

Military Products

Model		Element Technology		Turns		Si	ze		Packaging Options	Adjust	Page
Number	Cermet	W/W	Single	Multi	1/4"	3/8"	1/2"	1-1/4"	See Note 1	See Note 2	No.
RJ 12	• ят			•					T,B	S	11.
RJ 22	• 0 0			•			•		T,B	T,S	17
RJ/RJR 24*		/							T,B	T,S	23, 22
RJ/RJR 26									Т	S,T	19
RJ/RJR 50	•		•						Т	T	44
RT 12	8.7								T,B	S	10
RT/RTR 22					nault factory	aging, Op	eq • em	ids mupt	T,B	T,S	16
RT/RTR 24		•		•		•			a Side Ac T ustment	T,S	21
RT 26		•							T	T,S	18

NOTE 1: Standard packaging; some options may require alternate packaging. Consult factory. T = Tube, B = Bulk, E = Embossed Tape - 7" Reel, G = Embossed Tape - 13" Reel * Indicates patented models. **Optional products (not recommended for new designs).

NOTE 2: T = Top Adjustment, S = Side Adjustment, B = Bottom Adjustment



3/4" RECTANGULAR / MULTITURN CERMET / INDUSTRIAL / SEALED

- Low PC board profile only 1/4" high
- Panel mount option available (see page 62 for details)
- Transparent housing available, setting visually without hook-up and instrumentation ("P" style only)

Model 3006

Trimpot® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range10 to 5 megohms (see standard resistance table)

Resistance Tolerance±10% std. (tighter tolerance available)

Absolute Minimum Resistance1.0% or 2 ohms max.

(whichever is greater)

Contact Resistance Variation1.0% or 1 ohm max.

(whichever is greater) Adjustability Voltage.....±0.01% Resistance.....±0.05%

Resolution.....Infinite Insulation Resistance500 vdc. 1,000 megohms min.

Dielectric Strength Sea Level1,000 vac 80,000 Feet......250 vac Adjustment Angle15 turns nom.

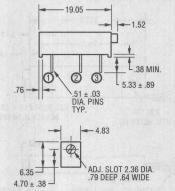
Environmental Characteristics

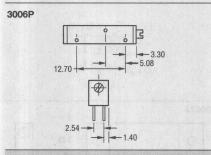
Power Rating (400 volts max.) 96 hours (3% ΔTR, 20 Megohms IR) Vibration......20G (2% ΔTR; 2% ΔVR) Shock......50G (2% ΔTR; 2% ΔVR) Load Life1,000 hours 0.75 watt 70°C (4% ATR) ...200 cycles Rotational Life.....200 cycles (3% ΔTR; 1% or 1 ohm,

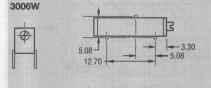
whichever is greater, CRV)

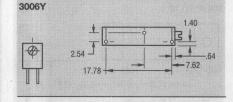
Physical Characteristics
Torque
Marking
Wiper Positioning50% nominal FlammabilityU.L. 94V-0 Standard Packaging25 pcs. per tube

COMMON DIMENSIONS

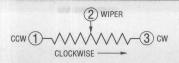








TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

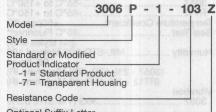


STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.

HOW TO ORDER

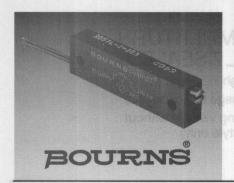


Optional Suffix Letter Panel Mount (Factory Installed)

Consult factory for other available options.

Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice. "Fluorinert" is a registered trademark of 3M Co.



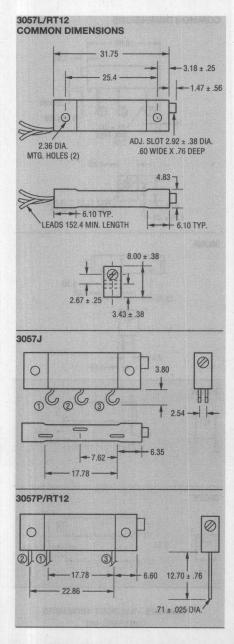
1-1/4" RECTANGULAR / MULTITURN WIREWOUND / INDUSTRIAL / SEALED

- Listed on the QPL for style RT12 per MIL-R-27208
- Panel mount option available (see page 62 for details)

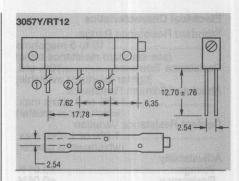
Model 3057/RT12

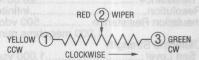
Trimpot® Trimming Potentiometers

Electrical Characteristics Standard Resistance Range Dielectric Strength - 3057 Dielectric Strength - RT12 **Environmental Characteristics** Power Rating @ 70°C 3057 Power Rating @ 85°C RT120.75 watt Power Rating @ 150°C0 watt Temperature Range 3057..... -55°C to +150°C RT12....-65°C to +150°C Temperature Coefficient.....±50ppm/°C Seal Test.........85°C Fluorinert* (pin styles only) HumidityMIL-STD-202 Method 106 96 hours (3057 - 2% ΔTR, 100 Megohms IR) (RT12 - 1% ATR, 10 Megohms IR) Vibration30G (1% ATR; 0.5% + resolution ΔVR) .20G (1% ΔTR; 0.5% + resolution AVR) 100G (1% ΔTR; 0.5% + resolution AVR) Load Life 3057......1,000 hours 1 watt @ 70°C RT121,000 hours 0.75 watt @ 85°C (2% ΔTR; 2% + resolution ΔVR) Rotational Life200 cycles (2% ΔTR) **Physical Characteristics** Terminals Weight0.10 oz. MarkingManufacturer's trademark, 3057..... resistance code, terminal numbers, date code, manufacturer's model number and style RT12.....Mil-spec part number Standard Packaging



TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

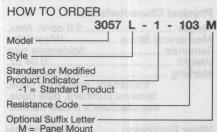




STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code	Nominal Resolution (Percent)
10 20 50 100 200 500 1,000 2,000 10,000 20,000 50,000	100 200 500 101 201 501 102 202 502 103 203 503	2.40 1.90 1.40 1.00 0.86 0.89 0.72 0.58 0.43 0.34 0.31

Popular values listed in boldface. Special resistances available.



M = Panel Mount (Factory Installed)

See page 70 for RT12 ordering information. Consult factory for other available options.

Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice. "Fluorinert" is a registered trademark of 3M Co.



1-1/4" RECTANGULAR / MULTITURN CERMET / INDUSTRIAL / SEALED

- Listed on the QPL for style RJ12 per MIL-R-22097
- Panel mount option available (see page 62 for details)

Model 3059/RJ12

Trimpot® Trimming Potentiometer

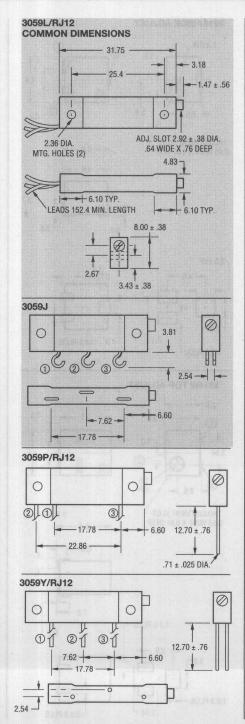
Electrical Characteristics

Standard Resistance Range 3059.....10 to 5 megohms RJ1210 to 1 megohm (see standard resistance table) Resistance Tolerance±10% std. (tighter tolerance available) (whichever is greater) Contact Resistance Variation 1.0% or 1 ohm max (whichever is greater) Adjustability Voltage±0.01% Resistance±0.05% Dielectric Strength Sea Level......900 vac 70,000 Feet350 vac Effective Travel22 turns nom. **Environmental Characteristics** Power Rating @ 70°C (400 volts max.)1.0 watt Power Rating @ 85°C Seal Test.....85°C Fluorinert* (pin styles only) HumidityMIL-STD-202 Method 106 3059(2% ΔTR, 10 Megohms IR) RJ12(1% ΔTR, 10 Megohms IR) Vibration20G (1% ΔTR; 1% ΔVR) 305950G (1% ΔTR; 1% ΔVR) RJ12100G (1% ΔTR; 1% ΔVR) Load Life 3059..........1,000 hours 1.0 watt @ 70°C (3% ΔTR; 1% or 1 ohms, whichever is greater, CRV) RJ12.......1,000 hours 0.75 watt @ 85°C Rotational Life..... whichever is greater, CRV **Physical Characteristics**5.0 oz-in. max. Torque.. Mechanical StopsWiper idles TerminalsSolderable printed circuit pinsMIL-STD-202; Method 208 Flexible leads(7 strands of 30 AWG) resistance code, terminal numbers, date code, manufacturer's model number and style Flammability......U.L. 94V-0 Standard Packaging P&Y Styles......10 pcs. per tube L&J Styles.....25 pcs. per bag Shaded areas typically not stocked by Distributors

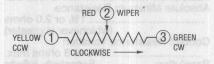
and not recommended for new designs.

Specifications are subject to change without notice.

""Fluorinert" is a registered trademark of 3M Co.



TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

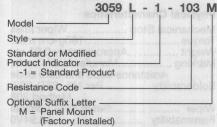


STANDARD RESISTANCE TABLE

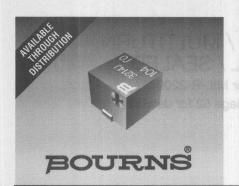
Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.

HOW TO ORDER



See page 71 for RJ12 ordering information. Consult factory for other available options.



SURFACE MOUNT 4MM SQUARE / MULTI-TURN CERMET / INDUSTRIAL / SEALED

- Sealed to withstand board wash processing
- Pick and place centering design, with flush adjustment
- 4mm design meets EIA/EIAJ/IPC/VRCI SMD standard trimmer footprint
- Top and side adjust styles
- J-hook, and gull-wing

3214G SIDE ADJUST

■ Patent #5047746 advanced drive/wiper mechanism

Model 3214

B[®] Trimming Potentiometer

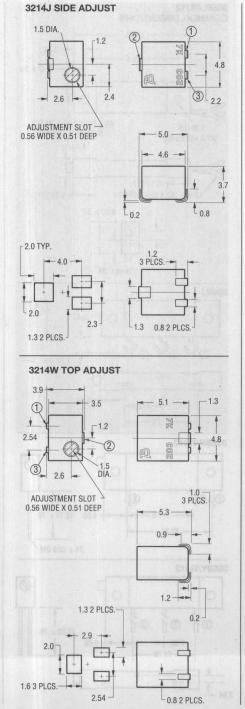
Electrical Characteristics

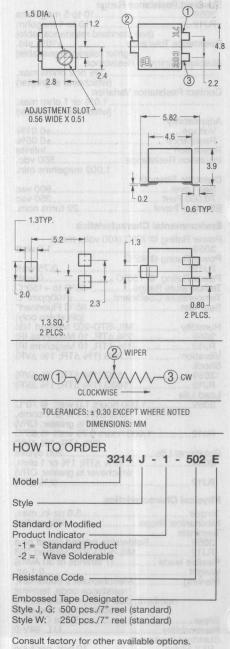
Environmental Characteristics

Power Rating (300 volts max.) 85°C0.25 watt 150°C0 watt Temperature Range-65°C to +150°C Temperature Coefficient±100ppm/°C HumidityMIL-STD 202 Method 106 TRS ±2%; IR 10 megohms Vibration20G TRS±1%; VRS ±1% Shock100G TRS ±1%; VRS±1% Load Life@ 85°C rated power 1,000 hours TRS 3 ohms or 3% (whichever is greater)
Rotational Cycling......200 cycles
TRS 3 ohms or 3% (whichever is greater) Thermal Shock.....5 cycles TRS±2%; VRS±1%

Physical Characteristics

Mechanical Stop	Wiper idles
	180g-cm max.
	oproximately 0.01 oz.
	Manufacturer's code,
	code and date code
	Per MIL-STD-202, Method 208
Wiper	Set at 50% nominal
	UL94V0



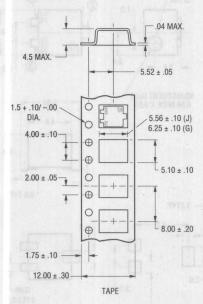


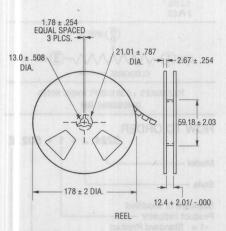
SURFACE MOUNT 4MM SQUARE / MULTI TURN CERMET / INDUSTRIAL / SEALED

Model 3214

B[®] Trimming Potentiometer

PACKAGING SPECIFICATIONS (J & G Styles)

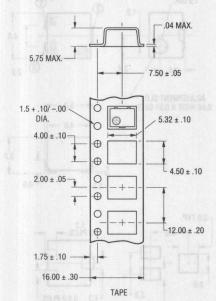


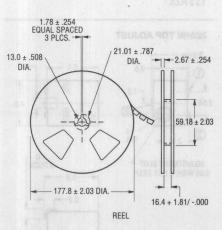


Cover tape peel strength: Meets EIA specification 481.

Units packaged 500 pieces per reel.

PACKAGING SPECIFICATIONS (W Style)





Cover tape peel strength: Meets EIA specification 481.

Units packaged 250 pieces per reel.

STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100 200 500 1,000 2,000 5,000 10,000 20,000 50,000	101 201 501 102 202 502 103 203 503 104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.



SURFACE MOUNT 4MM SQUARE / MULTI-TURN CERMET / INDUSTRIAL / SEALED

- Sealed to withstand board wash processing
- Pick and place centering design, with flush adjustment
- 4mm design meets EIA/EIAJ/IPC/VRCI SMD standard trimmer footprint
- Low CRV 1%
- DESC selected material drawing #92021

Model 3224

▶® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range10 to 2 megohm

(see standard resistance table)
Resistance Tolerance±10% std.

Contact Resistance Variation

Dielectric Strength
Sea Level600 vac (1minute)
Adjustment Angle11 turns nom.

Environmental Characteristics

Temperature Range _____-65°C to +150°C

Temperature Coefficient

#100ppm/°C
HumidityMIL-STD 202 Method 106
TRS ±2%; IR 10 megohms
Vibration20G TRS±1%; VRS ±1%
Shock100G TRS ±1%; VRS±1%

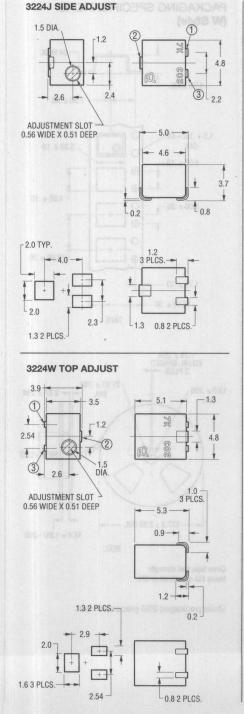
Load Life@ 85°C rated power 1,000 hours TRS 3 ohms or 3%

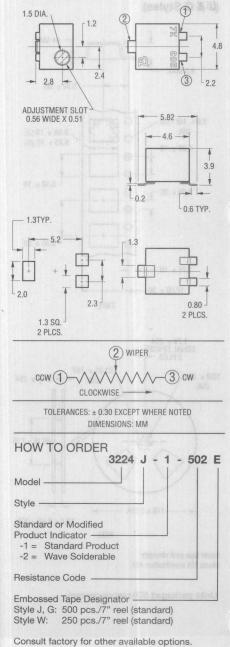
(whichever is greater)
Rotational Cycling......200 cycles
TRS 3 ohms or 3%
(whichever is greater)

Thermal Shock......5 cycles TRS±2%; VRS±1%

Physical Characteristics

Mechanical S	topWiper idles
	180g-cm max.
Weight	Approximately 0.01 oz.
	Manufacturer's code,
	stance code and date code
Solderability	Per MIL-STD-202,
	Method 208
Wiper	Set at 50% nominal
Flammability	UL94V0





3224G SIDE ADJUST

Specifications are subject to change without notice.

*"Fluorinert" is a registered trademark of 3M Co.

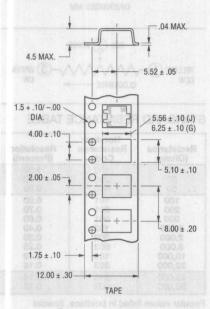
1/2" SQUARE / MULTITURN / WIREWOUND SEALED

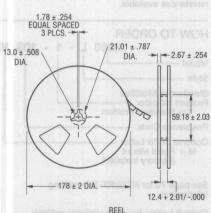
- Top and side adjust styles
- J-hook, and gull-wing
- Patent #5047746 advanced drive/wiper mechanism

Model 3224

B[®] Trimming Potentiometer

PACKAGING SPECIFICATIONS (J & G Styles)

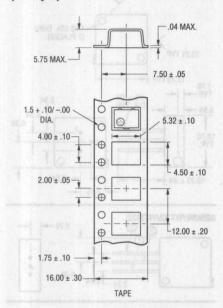


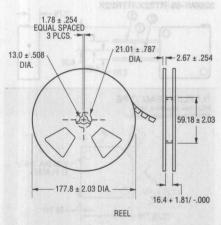


Cover tape peel strength: Meets EIA specification 481.

Units packaged 500 pieces per reel.

PACKAGING SPECIFICATIONS (W Style)





Cover tape peel strength: Meets EIA specification 481.

Units packaged 250 pieces per reel.

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.



1/2" SQUARE / MULTITURN / WIREWOUND SEALED

■ Listed on the QPL for style RT22 per MIL-R-27208 and RTR22 per High-Rel MIL-R-39015

Model 3250/RT22/RTR22

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
325010 to 50K ohms
RT2250 to 20K ohms
RTR22500 to 20K ohms
(see standard resistance table)
Resistance Tolerance±5% std.
(tighter tolerance available)
Absolute Minimum Resistance
0.1% or 1 ohm max. (whichever is greater)
Noise100 ohms ENR max.
ResolutionSee standard resistance table
Insulation Resistance500 vdc.
1,000 megohms min.

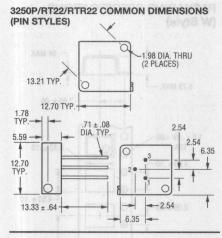
Dielectric Strength	
Sea Level	1,000 vac
80,000 Feet	400 vac
Adjustment Travel	25 turns nom.

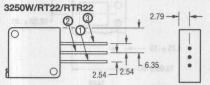
Environmental Characteristics

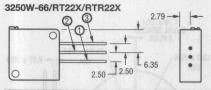
Power Rating @ 85°C
32501.0 watt RT22/RTR220.75 watt
RT22/RTR22 0.75 watt
Power Pating @ 150°C
Power Rating @ 150°C0 watt Temperature Range65°C to +150°C
Temperature Range65°C to +150°C
Temperature Coefficient
3250
RT22/RTR22±50ppm/°C
Seal Test85°C Fluorinert* (pin styles only)
HumidityMIL-STD-202 Method 106
3250(2% ΔTR; 100 Megohms IR)
RT22(1% ΔTR; 10 Megohms IR)
RTR22(1% ΔTR; 100 Megohms IR)
Vibration30G
(1% ΔTR; 0.5% + resolution ΔVR)
Shock100G
(1% ΔTR; 0.5% + resolution ΔVR)
Load Life
32501,000 hours 1.0 watt @ 85°C
(2% ΔTR; 500 ohms ENR)
RT221,000 hours 0.75 watt @ 85°C
(2% ΔTR; 2% + resolution ΔVR)
RTR2210,000 hours 0.75 watt @ 85°C
$(3\% \Delta TR; 2\% + resolution \Delta TR)$
Rotational Life
3250(2% ATR: 500 ohms ENR)
RT22/RTR22(2% ΔTR)

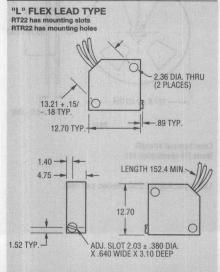
Physical Characteristics

Torque5.0 oz-in. max.
Mechanical StopsWiper idles Terminals
3250Solderable printed circuit pins Flexible leads (7 strands of 30 AWG)
RT22/RTR22MIL-STD-202; Method 208
Weight0.06 oz.
Weight0.06 oz. Machine Screw Mounting
Torque12 oz-in. max.
Marking
3250Manufacturer's trademark, resistance code, terminal numbers,
date code, manufacturer's model number and style
RT22/RTR22Mil-spec part number
WiperSet at CW end
FlammabilityU.L. 94V-0
Otan day Daylers's
Standard Packaging
P&W Styles25 pcs. per tube
L Style



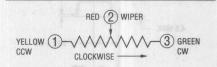






TOLERANCES: ± 0.25 EXCEPT WHERE NOTED

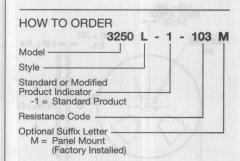
DIMENSIONS: MM



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Nominal Resistance Code	Resolution (Percent)
10	100	1.30
20	200	1.00
50	500	0.80
100	101	0.90
200	201	0.70
500	501	0.60
1,000	102	0.40
2,000	202	0.30
5,000	502	0.25
10,000	103	0.19
20,000	203	0.16
25,000	253	0.14
50,000	503	0.13

Popular values listed in boldface. Special resistances available.



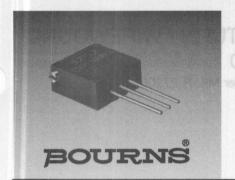
See page 70 for RT22/RTR22 ordering information.

Consult factory for other available options.

Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

*"Fluorinert" is a registered trademark of 3M Co.



1/2" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- Listed on the QPL for style RJ22 per MIL-R-22097
- Panel mount option available (see page 63 for details)

Model 3252/RJ22

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Ra	nge
3252 RJ22	10 to 2 megohms
RJ22	dard resistance table)
Resistance Tolerance	
(tighte	er tolerance available)
Absolute Minimum Resis	
3252	
	(whichever is greater)
RJ22 Contact Resistance Varia	1 ohm max.
0.000	
0202	(whichever is greater)
RJ22	2% or 2 ohms max.
	(whichever is greater)
Adjustability	0.0404
Voltage Resistance Resolution	±0.01%
Resolution	Infinite
Insulation Resistance	500 vdc
	1,000 megohms min.
Dielectric Strength	
Sea Level	1,000 vac
80,000 Feet	400 vac
Effective Travel	25 turns nom.

Environmental Characteristics

mittinointai onaraotoriotio
Power Rating @ 85°C (400 volts max.) 3252
Power Rating @ 150°C0 watt
Temperature Range65°C to +150°C
Temperature Range65°C to +150°C Temperature Coefficient±100ppm/°C
Seal Test85°C Fluorinert* (pin styles only)
Humidity
3252MIL-STD-202 Method 103; 96 hours
(1% Δ TR; 100 Megohms IR)
RJ22MIL-STD-202 Method 106
(1% Δ TR; 10 Megohms IR)
Vibration
3252 30G (1% ATR: 1% AVR)
325230G (1% ΔTR; 1% ΔVR) RJ2220G (1% ΔTR; 1% ΔVR)
Shock100G (1% ATR; 1% AVR)
Load Life
32521,000 hours 0.75 watt @ 85°C
(3% ΔTR; 3% or 3 ohms,
whichever is greater, CRV) RJ221,000 hours 0.5 watt @ 85°C
(2% ΔTR; 1%ΔVR)
Rotational Life200 cycles
3252(2% ΔTR; 3% or 3 ohms,
whichever is greater, CRV)
RJ222% ΔΤŔ

Physical Characteristics

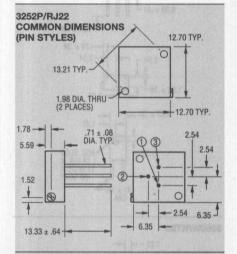
5.0 oz-in. max.
Wiper idles
ted circuit pins
2; Method 208
ds of 30 AWG)
0.065 oz.
Set at CW end
U.L. 94V-0

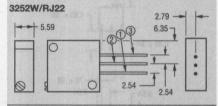
Machine Screw Mounting

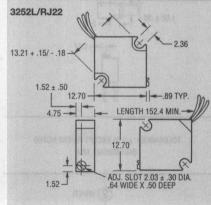
Torque5	oz-in.	max.
---------	--------	------

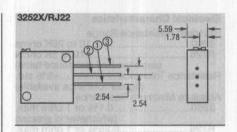
Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice. "Fluorinert" is a registered trademark of 3M Co.

Marking
3252 ...Manufacturer's trademark, resistance
code, wiring diagram, date code,
manufacturer's model number and style
RJ22Mil-spec part number

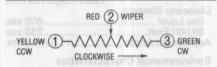








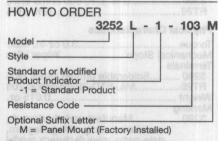
TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

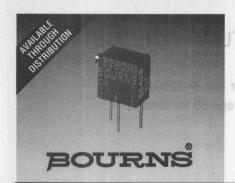


STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
(Ohms) 10 20 50 100 200 500 1,000 2,000 5,000 10,000 25,000 50,000 100,000 200,000 500,000	Code 100 200 500 101 201 501 102 202 502 103 203 253 503 104 204 504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.





1/4" SQUARE / MULTITURN / WIREWOUND INDUSTRIAL / SEALED

■ Listed on the QPL for style RT26 per MIL-R-27208

Model 3260/RT26

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range
326010 to 25K ohms
RT2610 to 5K ohms
(see standard resistance table)
Resistance Tolerance±5% std.
(tighter tolerance available)
Absolute Minimum Resistance
32600.1% or 1 ohm max.
(whichever is greater)
RT260.25% or 1 ohm max.
(whichever is greater)
Noise100 ohms ENR max.
ResolutionSee standard resistance table
Insulation Resistance500 vdc.
1,000 megohms min.
011 11 01
Sea Level600 vac
80,000 Feet250 vac
Adjustment Angle11 turns nom.
Aujustinent Angle11 turns nom.

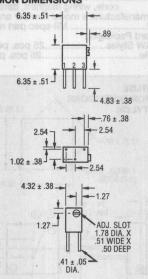
Environmental Characteristics

Power Rating	
85°C	0.25 watt
150°C	0,25 watt
Temperature Range	watt
3260	65°C to +150°C
DT26	55°C to +150°C
Tompoveture Coefficie	55 0 10 +150 0
Temperature Coefficie	
	±70ppm/°C
R126	±50ppm/°C
Seal Test	85°C Fluorinert*
HumidityMIL-S	
	FR, 100 Megohms IR)
RT26(1% /	TR, 10 Megohms IR)
Vibration	
3260	30G (1% ATR; 1%
	+ resolution AVR)
BT26	20G (1% ATR; 1%
	+ resolution ΔVR)
Shock	100G
	% + resolution ΔVR)
Load Life1,000 hou	
	ΔTR; 500 ohms ENR)
DT26 (20/ ATD: 2	$\frac{1}{2}$ % + resolution ΔVR)
Potational Life	+ resolution AVA)
Rotational Life	200 cycles
3200(2%	ΔTR; 500 ohms ENR)
H120	(2% \Delta TR)

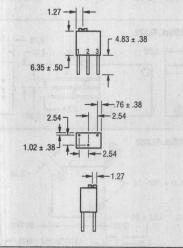
Physical Characteristics

Physical Characteristics
Torque3.0 oz-in. max. Mechanical StopsWiper idles Terminals
3260Solderable printed circuit pins RT26MIL-STD-202; Method 208
Weight0.015 oz.
Marking 3260Manufacturer's trademark, resistance code, wiring diagram, date code, manufacturer's model
number and style RT26Mil-spec part number WiperSet at CW end Standard Packaging50 pcs. per tube

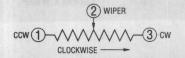
3260H/RT26 "X" STYLE COMMON DIMENSIONS



3260W/RT26



TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code	Nominal Resolution (Percent)
10	100	1.90
20 50	200	1.50
100	500 101	1.23
200	201	0.94
500	501	0.58
1,000	102	0.50
2,000	202	0.45
5,000 10,000	502 103	0.34
20,000	203	0.28
25,000	253	0.23

Popular values listed in boldface. Special resistances available.

HOW TO ORDER

	3260 H	- 1	- 502
Model —		tue?	80,000
Style -		VSTI 1	KIEDDIE
Standard or Modified Product Indicator	losis to is	Inetal	Emviror Power
-1 = Standard Produ	uct		3252
Resistance Code	country to come	of market	3018

See page 70 for RT26 ordering information. Consult factory for other available options.



1/4" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- Listed on the QPL for style RJ26 per MIL-R-22097 and RJR26 per High-Rel MIL-R-39035
- Patent #4427966 drive mechanism

Model 3262/RJ26/RJR26

Bourns® Trimming Potentiometer

Electrical Characteristics

80,000 Feet250 vac Effective Travel12 turns nom. **Environmental Characteristics** Power Rating (3262 300 volts max.; RJ26/RJR26 200 volts max.) 85°C0.25 watt 150°C ... 0 watt
Temperature Range ... -65°C to +150°C
Temperature Coefficient ... ±100ppm/°C
Seal Test ... 85°C Fluorinert* HumidityMIL-STD-202 Method 103 3262... 96 hours (2% ΔTR, 100 Megohms IR)

MIL-STD-202 Method 106

96 hours (1% ΔTR, 10 Megohms IR)

MIL-STD-202 Method 106

96 hours (1% ΔTR, 10 Megohms IR)

96 hours (1% ΔTR, 100 Megohms IR) RJ26 ... Vibration 326230G (1% ΔTR; 1% ΔVR) RJ26/RJR2620G (1% ΔTR; 1% ΔVR) Shock100G (1% ΔTR; 1% ΔVR) Shock whichever is greater, CRV) RJ26/RJR26(2% ΔTR)

Physical Characteristics

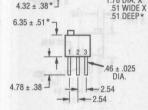
RJ26/RJR26......Positioned at 50% nominal Flammability.......U.L. 94V-0 Standard Packaging.......50 pcs. per tube

Shaded areas typically not stocked by Distributors and not recommended for new designs.

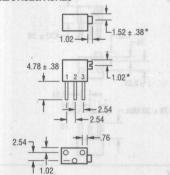
Specifications are subject to change without notice.

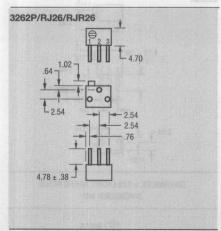
*"Fluorinert" is a registered trademark of 3M Co.

3262W/RJ26/RJR26 ADJ. SLOT 1.78 DIA. X 51 WIDE X 51 DEEP*

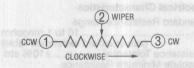


3262X/RJ26/RJR26





TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

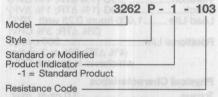


STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20 50	200
100	101
200	201
500	501
1,000 2,000	102
5,000	502
10,000	103
20,000	203
25,000 50,000	253 503
100.000	104
200,000	204
250,000 500,000	254 504
1,000,000	105

Popular values listed in boldface. Special resistances available.

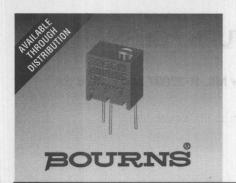
HOW TO ORDER



See page 72 for RJ26/RJR26 ordering information.

Consult factory for other available options.

*Common dimensions



1/4" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- Standoffs allow thorough PC board washing
- Tape and reel packaging available (see page 60 for details)
- Patent #4427966 drive mechanism

Model 3266

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range10 to 1 megohm (see standard resistance table) Resistance Tolerance±10% std. Absolute Minimum Resistance1% or 2 ohms max. (whichever is greater) Contact Resistance Variation3.0% or 3 ohms max. (whichever is greater) Adjustability Voltage.....±0.02% Resistance.....±0.05% Resolution..... Insulation Resistance500 vdc. 1,000 megohms min. Dielectric Strength Sea Level600 vac

80,000 Feet.....250 vac

Effective Travel......12 turns nom.

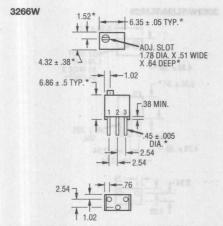
Environmental Characteristics

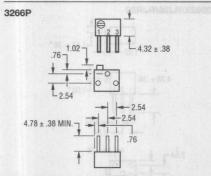
Physical Characteristics

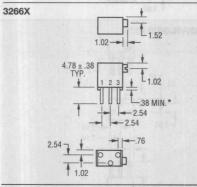
HOW TO ORDER

3266 W - 1 - 103

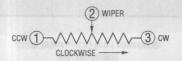
Model
Style
Standard or Modified
Product Indicator
-1 = Standard Product
Resistance Code
Consult factory for other available options.



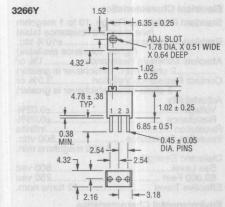


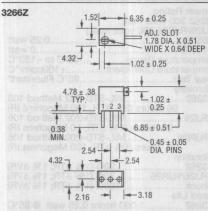


TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM



*Common dimensions





STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105

Popular values listed in boldface. Special resistances available.

Specifications are subject to change without notice.

*"Fluorinert" is a registered trademark of 3M Co.



3/8" SQUARE / MULTITURN / WIREWOUND INDUSTRIAL / SEALED

- Listed on the QPL for style RT24 per MIL-R-27208 and RTR24 per High-Rel MIL-R-39015
- Panel mount option available (see page 63 for details)

Model 3290/RT24/RTR24

Trimpot® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range	
329010 to 50K ohm	10
RT2410 to 10K ohm	
RTR24500 to 10K ohm	15
(see standard resistance tabl	(9
Resistance Tolerance±5% st	
(tighter tolerance availabl	e)
Absolute Minimum Resistance	
0.1% or 1 ohm ma	
(whichever is greate	er)
Noise100 ohms ENR ma	X.
Resolution	
(see standard resistance tabl	
Insulation Resistance500 vd	C.
1,000 megohms mi	
	11.
Dielectric Strength	
Sea Level1,000 va	C
00 000 F	100

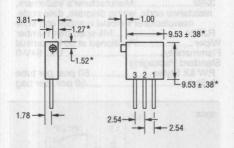
Adjustment Travel	25 turns nom.
Environmental Characteris	stics
Power Rating @ 85°C 3290	0 watt 65°C to +150°C ±50ppm/°C 85°C Fluorinert*
Humidity 3290	; 10 Megohms IR)
3290(1% ΔTR; 0.5% RT24/RTR24(1% ΔTR; 0.5%	30G + resolution ΔVR) 20G + resolution ΔVR) 100G + resolution ΔVR)
32901,000 hours (2% ΔTF RT241,000 hours (2% ΔTF; 2% RTR2410,000 hours	R; 500 ohms ENR) 0.75 watt @ 85° C + resolution Δ VR) 0.75 watt @ 85° C + resolution Δ VR) 200 cycles R; 500 ohms ENR)

Physical Characteristics

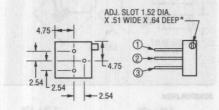
lorque		5.0 oz-in. max.
Mechanical	Stops	Wiper idles
Terminals	O STATE LANDS	Barrer and A Lamada and A de
		printed circuit pins D-202; Method 208
Weight		0.025 oz.
Marking		
3290		acturer's trademark, ode, wiring diagram.
		anufacturer's model

number and style
RT24/RTR24.....Mil-spec part number
Wiper.....Positioned at 50% nominal
Flammability....U.L. 94V-0
Standard Packaging.....50 pcs. per tube

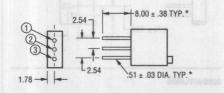
3290H/RT24X/RTR24X



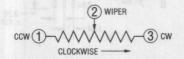
3290P/RT24/RTR24



3290W/RT24/RTR24



TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

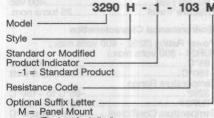


STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code	Nominal Resolution (Percent)
10	100	1.11
20	200	0.93
50	500	0.62
100	101	0.60
200	201	0.54
500	501	0.42
1,000	102	0.33
2,000	202	0.26
5,000	502	0.20
10,000	103	0.17
20,000	203	0.14
25,000	253	0.13
50,000	503	0.11

Popular values listed in boldface. Special resistances available.

HOW TO ORDER



M = Panel Mount (Factory Installed)

See page 70 for RT24/RTR24 ordering information.

Consult factory for other available options.

*Common dimensions



3/8" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- Listed on the QPL for style RJR24 per High-Rel MIL-R-39035
- Optional panel mount available (see page 63 for details)
- Patent #4427966 drive mechanism

Model 3292/RJR24

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Rar 3292RJR24	10 to 1 megohm
	dard resistance table)
Resistance Tolerance	
Absolute Minimum Resis	
3292	whichover is greater)
RJR24	1 ohm max.
Contact Resistance Varia	
32921	
	whichever is greater)
RJR24	
	whichever is greater)
Adjustability	
Voltage	±0.01%
Resistance	±0.05%
Resolution Insulation Resistance	Infinite
	1,000 megohms min.
Dielectric Strength	1 000
Sea Level	1,000 vac
80,000 Feet Effective Travel	400 vac
Ellective Iravel	25 turns nom.

Environmental Characteristics

militar official official deterior	
Power Rating (3292 - 400 vo RJR24 - 300 volts max.)	
85°C	0.5 watt
Temperature Range	
3292	65°C to +150°C
RJR24	
Temperature Coefficient	
Seal Test	85°C Fluorinert*
grinebile #SETTFUAS	(pin styles only)
Humidity	
3292MIL-STD 96 hours (1% ΔTR,	

3292	MIL-STD-202 Method 103
	hours (1% Δ TR, 100 Megohms IR)
RJR24	MIL-STD-202 Method 106
96	hours (1% Δ TR, 100 Megohms IR)
Vibration	Service and Contract of the Co
3292	30G (1% ΔTR; 1% ΔVR)
RJR24	20G (1% ATR; 1% AVR)

Snock	100G (1% ATR; 1% AVR)
Load Life	
3292	1,000 hours 0.5 watt @ 85°C
	(2% ΔTR; 3% or 3 ohms,
	whichever is greater, CRV
RJR24	10,000 hours 0.5 watt @ 85°C
	(3% ATR)
Rotational Life	200 cycles

.(2% ΔTR; 3% or 3 ohms,

whichever is greater, CRV)

Physical Characteristics

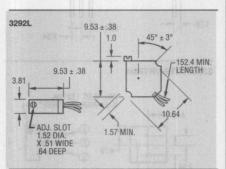
RJR24

lorque5.0 oz-in. max.
Mechanical StopsWiper idles
Terminals
3292Solderable printed circuit pins
RJR24MIL-STD-202 Method 208
Weight0.025 oz.
Machine Screw Mounting
Torque

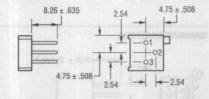
Marking
3292.....Manufacturer's trademark,
resistance code, wiring diagram, date code,
manufacturer's model number and style

manufacturer's model number and style
RJR24Mil-spec part number
WiperPositioned at 50% nominal
FlammabilityU.L. 94V-0
Standard Packaging

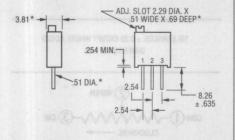
P,W &X Styles50 pcs. per tube L Style......50 pcs. per bag



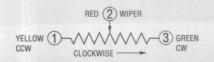
3292P/RJR24



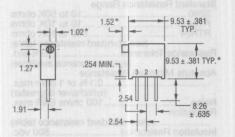
3292W/RJR24



TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM



3292X/RJR24



STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100 200 500 1,000 2,000 5,000 10,000 25,000 50,000 100,000	101 201 501 102 202 502 103 203 253 503 104
200,000	204
250,000	254
500,000	504
1,000,000	105

Popular values listed in boldface. Special resistances available.

HOW TO ORDER



M = Panel Mount Model 3292L, W & X (Factory Installed)

See page 72 for RJR24 ordering information.

Consult factory for other available options.

*Common dimensions

Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

*"Fluorinert" is a registered trademark of 3M Co.



3/8" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- 5 terminal styles
- Tape and reel packaging available (see page 60 for details)
- Standoffs
- Patent #4427966 drive mechanism

Model 3296/RJ24

Bourns® Trimming Potentiometer

Electrical Characteristics

Resolution	Infinite
Insulation Resistance	
1,000 mego	hms min.
Dielectric Strength	
Sea Level	900 vac
70,000 Feet	350 vac
Effective Travel25 tu	rns nom.

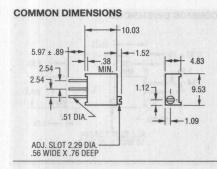
Environmental Characteristics

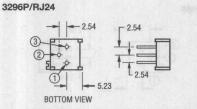
Elivironiniental Ollaracteristics
Power Rating (300 volts max.) 85°C0.5 watt 150°C0 watt
Temperature Range
55°C to +150°C Temperature Coefficient
±100ppm/°C
Seal Test85°C Fluorinert*
HumidityMIL-STD-202 Method 103
96 hours
(1% ΔTR, 10 Megohms IR)
Vibration20G (1% ΔTR; 1% ΔVR)
Shock100G (1% ΔTR; 1% ΔVR)
Load Life
1.000 hours 0.5 watt @ 70°C
(2% ΔTR: 1% ΔVR)
Rotational Life200 cycles
(2% ΔTR: 1% ΔVR)
(2% ΔIR, 1% ΔVR)

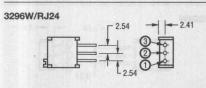
Physical Characteristics

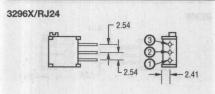
Filysical Characte	Houco
	3.0 oz-in. max.
	Wiper idles
Terminals	Solderable pins
Weight	0.03 oz.
	Manufacturer's
tradem	ark, resistance code,
wiring	diagram, date code,
r	nanufacturer's model
	number and style
WiperPosition	oned at 50% nominal
	UI 94V-0

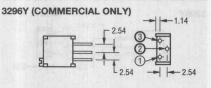
Standard Packaging50 pcs. per tube

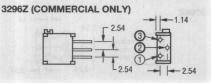




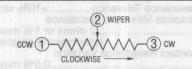








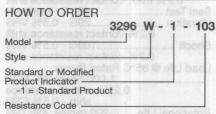
TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM



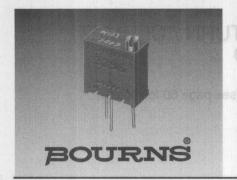
STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.



See page 71 for RJ24 ordering information. Consult factory for other available options.



HIGH PERFORMANCE SERIES 3/8" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- 5 terminal styles
- Thin body profile
- Sealed to withstand board washing processes
- Patent #4427966, #4732802, #4824694
 - Low current applications <50uA

Model 3296-LC2

Bourns® Trimming Potentiometer

Electrical Characteristics

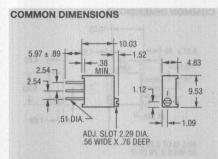
Standard Resistance Range500 ohms to 100K ohms (see standard resistance table) Resistance Tolerance±10% std.
Absolute Minimum Resistance2 ohms or 1% max. (whichever is greater) Contact Resistance Variation0.5% max. Contact Resistance (D.C. mode)0.3% max. Adjustability Voltage.....±0.1% Resistance±0.2% Insulation Resistance500 vdc. 1,000 megohms min. Dielectric Strength Sea Level900 vac 70,000 feet.....350 vac

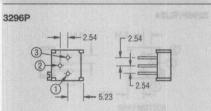
Adjustment Angle, Electrical25 ±5 turns **Environmental Characteristics** Power Rating (400 volts max.) 85°C0.5 watt 125°C0 watt Temperature Range-55°C to +125°C Temperature Coefficient ±100ppm/°C Humidity.......80-90%, RH, 10 cycles 2% max. TRS, IR 10 megohms 0.2% max. contact resistance shift Seal Test85° C Flourinert* Vibration20G - 0.5% VRS 0.2% contact resistance shift Shock100G - 0.5% VRS 0.2% contact resistance shift Load Life @ 85°C Rated Power1,000 hours 3% TRS, 0.2% contact resistance shift - 0.5% CRV Rotational Life......200 cycles, 4% TRS 0.2% contact resistance shift Thermal Shock......5 cycles 2% TRS, 0.5% VRS

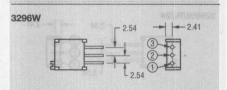
Physical Characteristics

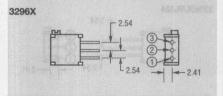
	3.0 oz-in. max.
Mechanical Stops	Wiper idles
	Solderable PC pins
	0.03 oz.
	Manufacturer's
trademai	rk, resistance code or
	value and date code
Wiper	Set at CW end
Flammability	U.L. 94V-0
	g50 pcs. per tube

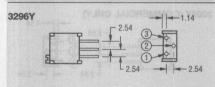
0.2% contact resistance shift

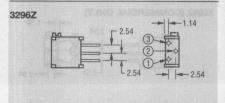


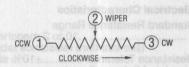












TOLERANCES: ± 0.25 EXCEPT WHERE NOTED

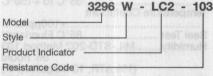
DIMENSIONS: MM

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
500	501
1.000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104

Popular values listed in boldface. Special resistances available.

HOW TO ORDER

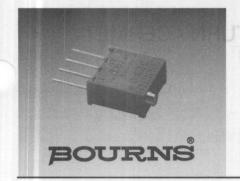


Consult factory for other available options.

Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

*"Fluorinert" is a registered trademark of 3M Co.



3/8" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- Designed for operational amplifier offset voltage adjustment applications
- Reduces power supply drift errors
- Unique center tapped trimming potentiometer
- Vertical and horizontal adjust types available
- Patent #4427966 drive mechanism

Model 3296-OT1

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range (Pin 1 to Pin 3)

(see standard resistance table)
Resistance Tolerance±20% std.
Absolute Minimum Resistance

Environmental Characteristics

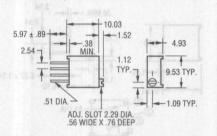
.....-55°C to +125°C Temperature Stability (ΔVR)

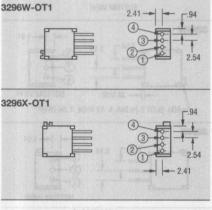
Physical Characteristics

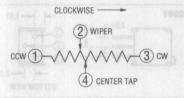
Standard Packaging50 pcs. per tube/tray

Also see Model 3386-OT1, page 57.

COMMON DIMENSIONS





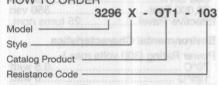


STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105

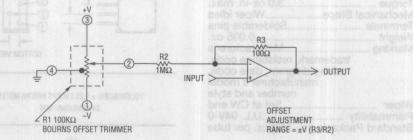
Popular values listed in boldface. Special resistances available.

HOW TO ORDER



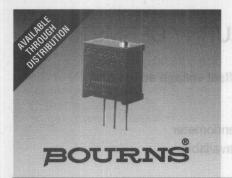
TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

SUGGESTED OFFSET VOLTAGE ADJUSTMENT CIRCUIT



Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice. ""Fluorinert" is a registered trademark of 3M Co.



3/8" SQUARE / MULTITURN / CERMET INDUSTRIAL / SEALED

- Five popular terminal styles
- Standoffs
- Patent #4427966 drive mechanism

Model 3299

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range10 to 5 megohms (see standard resistance table) Resistance Tolerance±10% std. (tighter tolerance available) Absolute Minimum Resistance1% or 2 ohms max. (whichever is greater) Contact Resistance Variation1.0% or 3 ohms max. (whichever is greater) Adjustability Voltage.....±0.01% Resistance.....±0.05%

Resolution.....Infinite Insulation Resistance500 vdc. 1,000 megohms min. Dielectric Strength Sea Level900 vac

70,000 Feet......350 vac Effective Travel......25 turns nom.

Environmental Characteristics Power Rating (300 volts max.) 70°C0.5 watt 96 hours (2% Δ TR, 10 Megohms IR) Vibration......20G (1% ΔTR; 1% ΔVR) Shock......100G (1% ΔTR; 1% ΔVR) Load Life1,000 hours 0.5 watt @ 70°C (3% ΔTR; 3% or 3 ohms, whichever is greater, CRV)

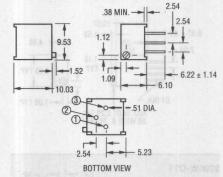
Rotational Life......200 cycles

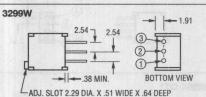
(4% ΔTR; 3% or 3 ohms,

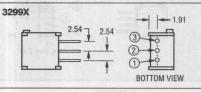
whichever is greater, CRV)

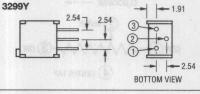
Physical Characte	eristics
Mechanical Stops.	3.0 oz-in. max. Wiper idles
	Solderable pins0.035 oz.
traden wiring	Manufacturer's nark, resistance code, g diagram, date code, manufacturer's model
Flammability	number and style Set at CW end U.L. 94V-0 g50 pcs. per tube

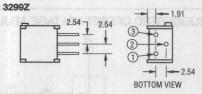




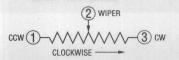








TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

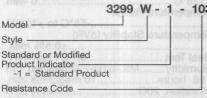


STANDARD RESISTANCE TABLE

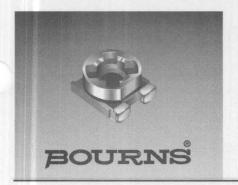
Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101 atuloedA
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.

HOW TO ORDER



Consult factory for other available options.



SURFACE MOUNT 2MM SQUARE / SINGLE TURN CERMET / OPEN FRAME

- Recommended for reflow processing
- Rotor design compatible with automatic adjustment equipment
- Supplied in 8mm embossed tape, compatible with automatic assembly equipment
- 2mm size meets EIA/EIAJ standard trimmer footprint

Model 3302

B[®] Trimming Potentiometer

FOR PACKAGING SPECIFICATIONS, SEE FOLLOWING PAGE.

Electrical Characteristics

Standard Resistance Range200 to 1 megohm (see standard resistance table)
Resistance Tolerance±25% std.
Absolute Minimum Resistance
<1K20 ohms max.
>1K5% max.

Environmental Characteristics

Physical Characteristics

TRS ±15%

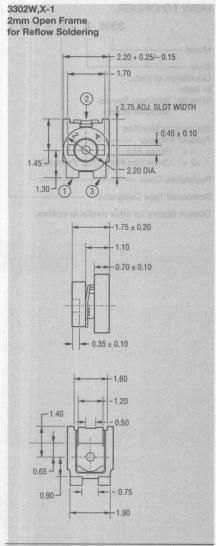
STANDARD RESISTANCE TABLE

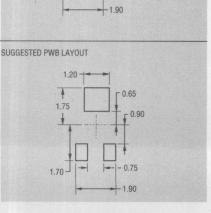
Resistance	Part Marking	Resistance
(Ohms)	Code	Code
200	22	201
500	52	501
1,000	13	102
2,000	23	202
5,000	53	502
10,000	14	103
20,000	24	203
50,000	54	503
100,000	15	104
200,000	25	204
500,000	55	504
1,000,000	16	105

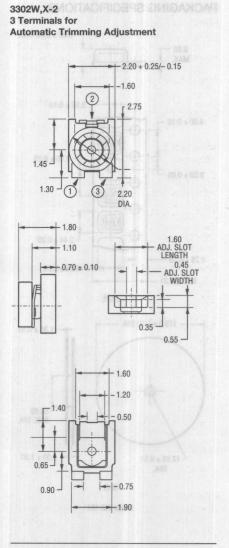
Popular values listed in boldface.

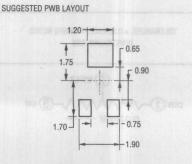
Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.









SURFACE MOUNT 2MM SQUARE / SINGLE TURN CERMET / OPEN FRAME

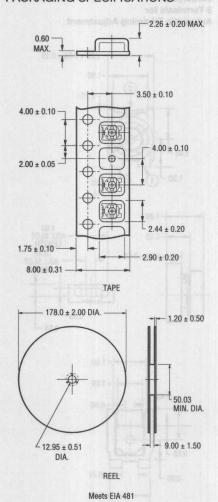
Supplied in Strint embossed tabe, compatible with automatic

Model 3302

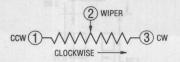
B® Trimming Potentiometer

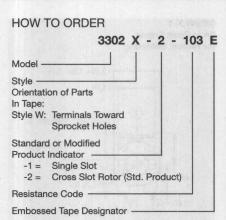
FOR PRODUCT SPECIFICATIONS, SEE PREVIOUS PAGE.

PACKAGING SPECIFICATIONS



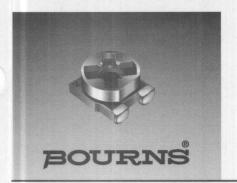
TOLERANCES: ± 0.30 EXCEPT WHERE NOTED DIMENSIONS: MM





Consult factory for other available options.

Specifications are subject to change without notice.



SURFACE MOUNT 3MM SQUARE / SINGLE TURN CERMET / OPEN FRAME

- Recommended for reflow processing
- Rotor design compatible with pick and place and automatic adjustment equipment
- Supplied in 8mm embossed tape, compatible with automatic assembly equipment

Model 3303

P® Trimming Potentiometer

FOR PACKAGING SPECIFICATIONS, SEE FOLLOWING PAGE.

Electrical Characteristics

Standard Resistance Range

≤ 1K Ohms20 ohms max. >1K Ohms2% max. of TR Contact Resistance Variation

Environmental Characteristics

Resistance to Soldering Heat260°C, 10 seconds, TRS max. 5% Power Rating (50 VDC max.)

.....-40°C to +85°C Temperature Coefficient

±250ppm/°C
Humidity95%RH
500 hours

TRS max.±5% Load Life@ 70°C rated power 500 hours TRS ±5%

....20 turns TRS ±15%

Physical Characteristics

Rotational Cycling.....

Torque.......20-200g-cm max.
Mechanical AngleContinuous
Marking......Part marking code
Standard Packaging

......2000 pcs./7" reel

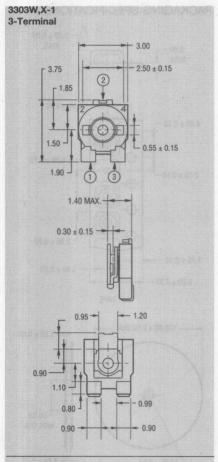
STANDARD RESISTANCE TABLE

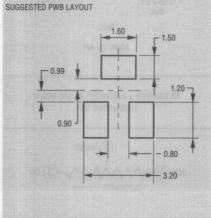
Resistance	Part Marking	Resistance
(Ohms)	Code	Code
100	12	101
200	22	201
500	52	501
1,000	13	102
2,000	23	202
5,000	53	502
10,000	14	103
20,000	24	203
50,000	54	503
100,000	15	104
200,000	25	204
500,000	55	504
1,000,000	16	105

Popular values listed in boldface.

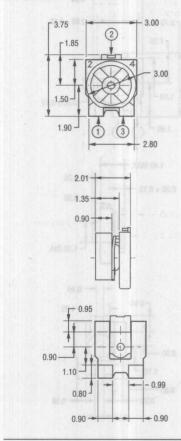
Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

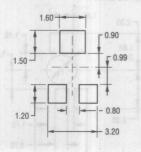




3303W,X-2 3mm Open Frame for Reflow Soldering 3-Terminal







SURFACE MOUNT GWW/SQUARE / SINGLE TURN CERMET / OPEN FRAME

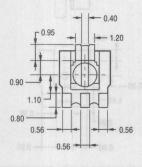
- Rear adjust version available
- 3mm size meets EIA/EIAJ standard trimmer footprint

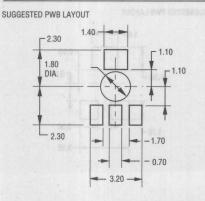
Model 3303

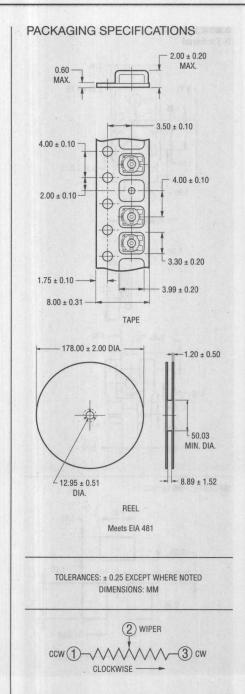
B® Trimming Potentiometer

FOR PRODUCT SPECIFICATIONS, SEE PREVIOUS PAGE.

3303C,D 3-Terminal Both Sides Adjust 3.00 2.50 ± 0.15 1.90 1 2 3 1.40 MAX. 0.30 ± 0.15









Humidity Schiller Schiller Schiller Schiller Schiller Load Life Control Cycling Schiller Schi



SURFACE MOUNT 4MM SQUARE / SINGLE-TURN CERMET / INDUSTRIAL / OPEN FRAME

- Two cross-slot rotor designs suitable for automatic adjustment equipment
- Supplied in 12mm embossed tape, compatible with automatic assembly equipment
- Choice of two packaging orientations
- Recommended for reflow solder processing only

Model 3304

P® Trimming Potentiometer

FOR ADDITIONAL STYLES, SEE FOLLOWING PAGE.

Electrical Characteristics

Environmental Characteristics

10 Ohms to 200 Ohms±250ppm/°C 500 Ohms and above±200ppm°C Humidity......MIL-STD-202 Method 103 500 hours

(5% ΔTR) Styles A,B,W & X
SRS ±5% Styles C & D
Vibration........30G (2% ΔTR; 2% ΔVR)
Styles A,B,W & X
SRS ±5% Styles C & D
Shock.......100G (2% ΔTR; 2% ΔVR)
Styles A,B,W & X

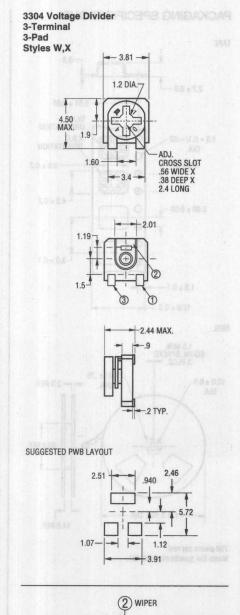
SRS ±5% Styles C & D Load Life1,000 hours 0.2 watt @ 70°C

(5% (ΔTR) Styles A,B,W & X SRS ±5% Styles C & D Rotational Life20 cycles (15% ΔTR)

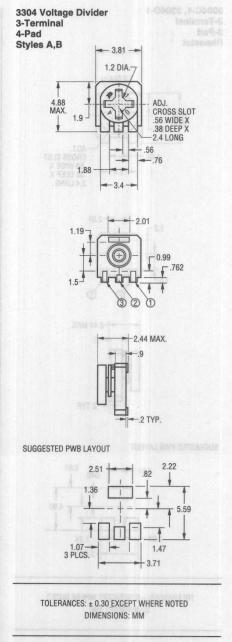
Physical Characteristics

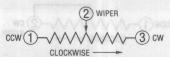
Torque (Operating).......3.0 oz-in. max. Mechanical AngleContinuous MarkingManufacturer's trademark, resistance code, manufacturer's full part number and date code on packaging Terminals......Solder coated WiperPositioned at 50% nominal Standard Packaging

......750 pcs./7" reel Reflow solder processing recommended



CLOCKWISE -





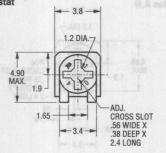
SURFACE MOUNT 4MM SQUARE / SINGLE-TURN CERMET / INDUSTRIAL / OPEN FRAME

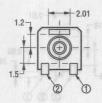
Model 3304

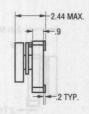
B® Trimming Potentiometer

FOR PRODUCT SPECIFICATIONS, SEE PREVIOUS PAGE.

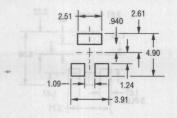
3304C-1, 3304D-1 2-Terminal 3-Pad Bheostat



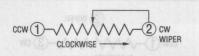




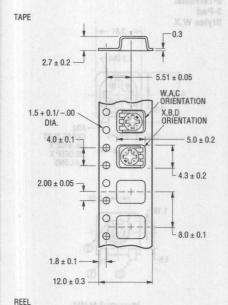
SUGGESTED PWB LAYOUT

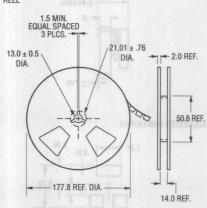


TOLERANCES: ± 0.30 EXCEPT WHERE NOTED DIMENSIONS: MM



PACKAGING SPECIFICATIONS



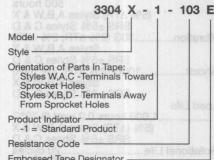


750 pieces per reel. Meets EIA specification RS-481.

STANDARD RESISTANCE TABLE

Resistance	-1 Resistance	-2 Resistance
(Ohms)	Code	Code
10	100 200	A1 21
50	500	51
100	101	A2
200	201	22
500	501	52
1,000	102	A3
2,000	202	23
5,000	502	53
10,000	103	A4
20,000	203	24
50,000	503	54
100,000	104	A5
200,000	204	25
500,000	504	55
1,000,000	105	A6
2,000,000	205	26

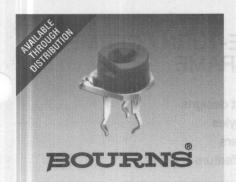
HOW TO ORDER



Embossed Tape Designator

E = 750 pcs./7" reel (-1 standard)
500 pcs./7" reel (-2 standard)
G = 3000 pcs./13" reel (-1 optional)

Consult factory for other available options.



6MM ROUND / SINGLE-TURN / CERMET INDUSTRIAL / OPEN FRAME

- Cross slot adjustment options
- Horizontal and vertical mounting styles
- Dust resistant/splash resistant covers
- PC board stand-offs and retention feature
- Front and top adjust styles

Model 3306

Bourns® Trimming Potentiometer

Electrical Characteristics

Environmental Characteristics

Physical Characteristics

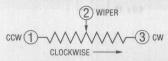
Aqueous cleaning not recommended

STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
100 200 500 1,000 2,000 5,000 10,000 25,000 50,000 100,000	101 201 501 102 202 502 103 203 253 503 104
200,000	204
250,000	254
500,000	504
1,000,000	105

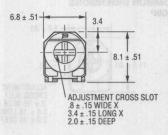
Shaded area not typically stocked by Distributors and not recommended for new designs.

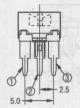
TOLERANCES: ± 0.30 EXCEPT WHERE NOTED DIMENSIONS: MM

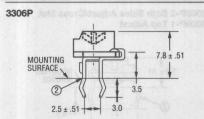


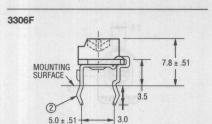
Specifications are subject to change without notice.

TOP ADJUST COMMON DIMENSIONS

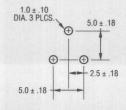




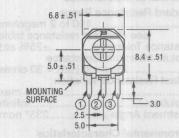


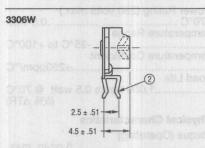


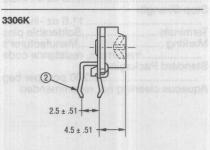
SUGGESTED PWB LAYOUT - STYLE F

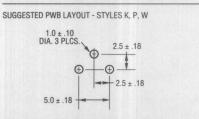


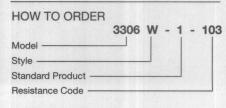
SIDE ADJUST COMMON DIMENSIONS













9MM ROUND / SINGLE-TURN / CERMET INDUSTRIAL / OPEN FRAME

- Both sides adjust
- Cross slot and hexagon adjustment designs
- Horizontal and vertical mounting styles
- Dust resistant/splash resistant covers
- PC board stand-offs and retention feature

Model 3309

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range

......100 to 2 megohms (see standard resistance table)
Resistance Tolerance±25% std.

Absolute Minimum Resistance2% max. (≤2K = 30 ohms)

Contact Resistance Variation

Environmental Characteristics

Temperature Range-25°C to +100°C

Temperature Coefficient

.....±250ppm/°C

.....1,000 hours 0.5 watt @ 70°C

(5% ΔTR)

Physical Characteristics

Torque (Operating)

.....5 oz-in. max.

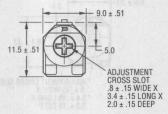
Stop Strength

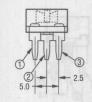
MarkingManufacturer'strademark, resistance code

Standard Packaging

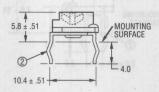
......200 pcs. per bag Aqueous cleaning not recommended

TOP/BOTTOM ADJUST COMMON DIMENSIONS 3309P



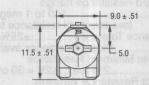


3309P-2 Both Sides Adjust/Cross Slot 3309P-1 Top Adjust

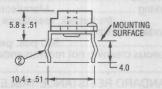




3309P-3 Both Sides Adjust Hex

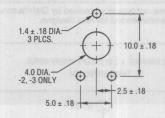








SUGGESTED PWB LAYOUT - 3309P



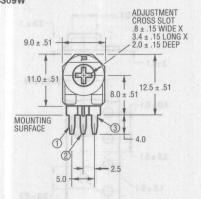
Specifications are subject to change without notice.

SURFACE MOUNT 3MM SQUARE/ SINGLE-TURN CERMET / SEALED

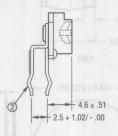
Model 3309

Bourns® Trimming Potentiometer

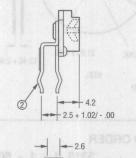
SIDE ADJUST COMMON DIMENSIONS 3309W



3309W-1 Single Side (Front) Adjust

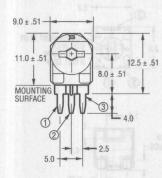


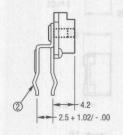
3309W-2 Both Sides Adjust - Cross Slot





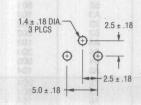
3309W-3 Both Sides Adjust Hex



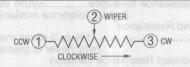




SUGGESTED PWB LAYOUT - 3309W



TOLERANCES: ± 0.30 EXCEPT WHERE NOTED
DIMENSIONS: MM



STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
100	101
200	201
500	501
1,000 2,000 5,000 10,000 20,000 25,000 50,000	102 202 502 103 203 253 503 104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.

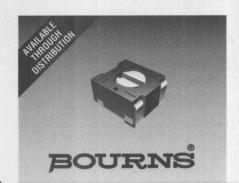
HOW TO ORDER

Model

Pin Style

Rotor Style

-2 = Cross Slot/Single Slot Rear Adjust
-3 = 2mm Hex Thru Hole



SURFACE MOUNT 3MM SQUARE / SINGLE-TURN CERMET / SEALED

- Compatible with surface mount manufacturing processes
- Rotor stop for "in-circuit" adjustment
- 100 cycle rotational and seal life
- Patent #5043695 assembly for seal integrity
- Plastic housing for RF applications

Model 3313

B® Trimming Potentiometer

Electrical Characteristics

......1% or 3 ohms max. (whichever is greater)

Contact Resistance Variation3% or 3 ohms

Environmental Characteristics

Max. Soldering Exposure260°C/5 seconds Power Rating (200 volts max.)

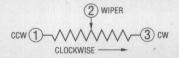
......≤100 ohms ±150ppm/°C; >100 ohms ±100ppm/°C Seal Test85°C Fluorinert* HumidityMIL-STD 202, Method 106 (no vibration) TRS ±3%;

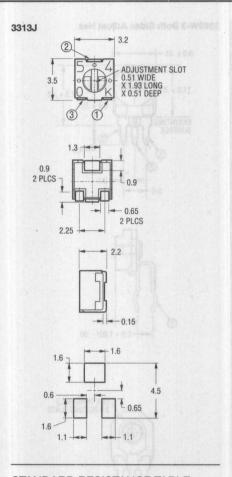
IR 10 megohms
Vibration20G TRS ±1%; VRS ±1%
Shock100G TRS ±1%; VRS ±1%
Load Life1000 hours
@ 70°C Rated Power;TRS ± 3%

Rotational Life100 cycles TRS ±3%
Thermal Shock5 cycles
TRS ±2%; VRS ±1%

Physical Characteristics

TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM



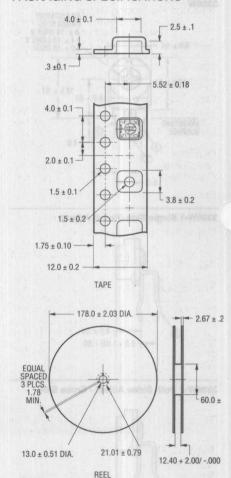


STANDARD RESISTANCE TABLE

Resistance	Part Marking	Resistance
(Ohms)	Code	Code
10	A1	100
20	21	200
50	51	500
100 200 500 1,000 2,000 5,000 10,000 50,000 100,000	A2 22 52 A3 23 53 A4 24 54 A5	101 201 501 102 202 502 103 203 503 104
200,000	25	204
500,000	55	504
1,000,000	A6	105
2,000,000	26	205

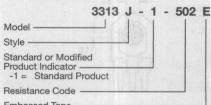
Popular values listed in boldface. Special resistances available.

PACKAGING SPECIFICATIONS



HOW TO ORDER

Meets EIA 481



Embossed Tape — 1000 pcs. / 7" Reel (Standard)

Specifications are subject to change without notice.

*"Fluorinert" is a registered trademark of 3M Co.



SURFACE MOUNT 4MM SQUARE /SINGLE TURN CERMET / INDUSTRIAL / SEALED

- Compatible with surface mount manufacturing processes
- Compatible with popular vacuum pick-and-place equipment
- J-hook, gull-wing and pinned configurations
- Side adjust available

Model 3314

B® Trimming Potentiometer

Electrical Characteristics

FOR PACKAGING SPECIFICATIONS, SEE FOLLOWING PAGE.

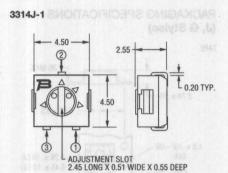
Standard Resistance Range10 ohms to 2 megohms (see standard resistance table) Resistance Tolerance±20% std.(tighter tolerance available) End Resistance1% or 2 ohms max. (whichever is greater) Contact Resistance Variation1% or 3 ohms

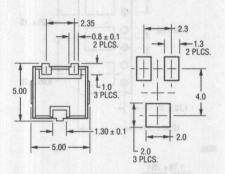
modiation modistance
100 megohms min.
100 megorins min.
Dielectric Strenath
Sea Level500 vac (1 minute)
Adjustment Angle210° nom.
Adjustifient Angle210 Hom.

Environmental Characteristics

Thermal Shock5 cycle TRS ±2%; VRS ±19	S
Physical Characteristics	
Mechanical Angle	al al mz. seal 0 el el

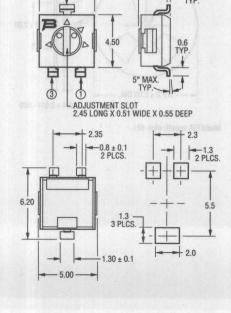
Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice.

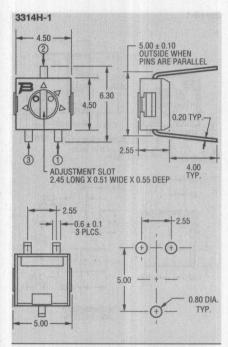




2.55

3314G-1



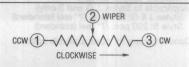


STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special

TOLERANCES: ± 0.25 EXCEPT WHERE NOTED **DIMENSIONS: MM**



SURFACE MOUNT 4MM SQUARE /SINGLE TURN CERMET / INDUSTRIAL / SEALED

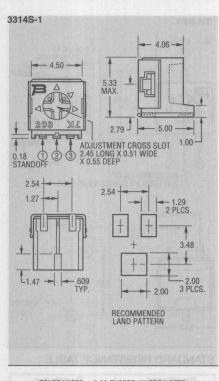
- Meets EIA/EIAJ/IPC/VRCI SMD standard trimmer designs
- Model 3314 has been approved for use by DESC on drawings 88039 (3314J) and 90027 (3314G)

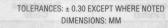
J-hook; gulf-wing and pinned configurations

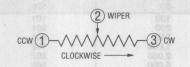
Model 3314

B® Trimming Potentiometer

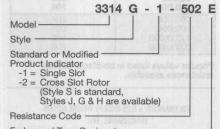
FOR PRODUCT SPECIFICATIONS, SEE PRIOR PAGE.







HOW TO ORDER



Embossed Tape Designator

(Applicable to Styles J, G and S only)

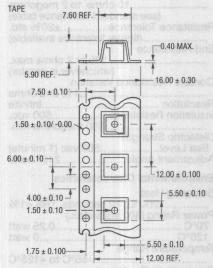
Styles J & G: 500 pcs. /7" reel (standard)

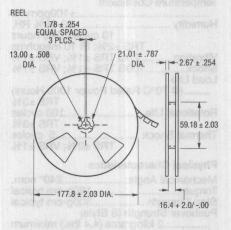
Style S: 200 pcs. /7" reel (standard)

Consult factory for other available options.

PACKAGING SPECIFICATIONS (J, G Styles) TAPE 36 MAX 2.74 ± .10 - 5.52 ± 0.5 1.5 + .10/ -.000 DIA. $5.26 \pm .10 (J)$ 0 6.45 ± .10 (G) 4.00 ± .10 0 0 5.26 ± .10 2.00 ± .05 0 0 0 0 8.00 ± .20 1.75 ± .10 -12.00 ± .30 REEL 1.78 ± .254 EQUAL SPACED 3 PLCS. 21.01 ± .787 13.0 ± .508 2.67 ± .254 DIA. DIA 00 59.18 ± 2.03 177.8 ± 2.03 DIA. 12.4 + 2.01/ -.000 Meets EIA specification 481.

PACKAGING SPECIFICATIONS (S Style) TAPE 7.60 RFF





Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice.



6MM SQUARE / SINGLE-TURN / CARBON COMMERCIAL / OPEN FRAME

- Cross slot rotor design suitable for automatic adjustment equipment
- Board retention feature
- Enclosed cover
- PC board stand-offs
- Adjustable front/back, top/bottom

Model 3318

Bourns® Trimming Potentiometer

Electrical Characteristics

Adjustment Angle210° ±20°

Environmental Characteristics

Physical Characteristics

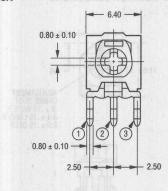
STANDARD RESISTANCE TABLE

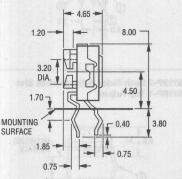
Resistance	Resistance
(Ohms)	Code
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105

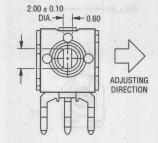
Popular values listed in boldface.

TOLERANCES: ± 0.30 EXCEPT WHERE NOTED DIMENSIONS: MM

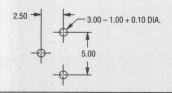
3318K

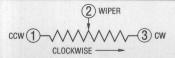




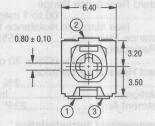


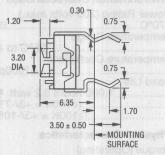
SUGGESTED PWB

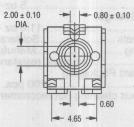


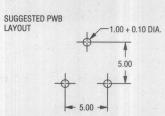


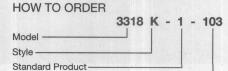
3318F











Resistance Code



9MM ROUND / SINGLE-TURN / CARBON COMMERCIAL / OPEN FRAME

- Both sides adjust
- Cross slot and hexagon adjustment designs
- Horizontal and vertical mounting styles
- Dust resistant/splash resistant covers
- PC board stand-offs and retention feature

Model 3319

Bourns® Trimming Potentiometer

Electrical Characteristics

Resolution.....Infinite

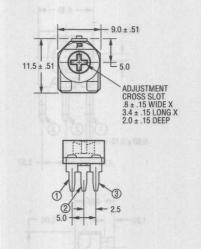
Adjustment Angle235° nom.

Physical Characteristics

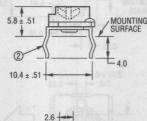
Torque (Operating)

......200 pcs. per bag Aqueous cleaning not recommended

3319P COMMON DIMENSIONS

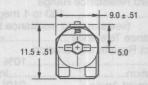


3319P-2 Both Sides Adjust/Cross Slot 3319P-1 Top Adjust

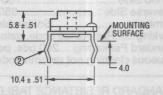




3319P-3 Both Sides Adjust/Hex

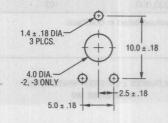








SUGGESTED PWB LAYOUT - 3319P

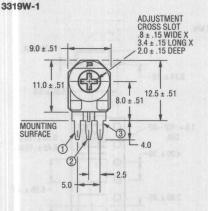


Specifications are subject to change without notice.

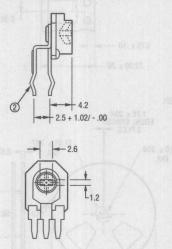
Model 3319

Bourns® Trimming Potentiometer

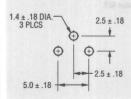
SIDE ADJUST



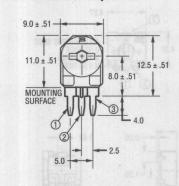
3319W-2 Both Sides Adjust /Cross Slot

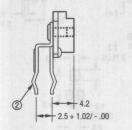


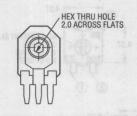
SUGGESTED PWB LAYOUT - 3319W



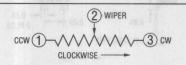
3319W-3 Both Sides Adjust/Hex







TOLERANCES: ± 0.30 EXCEPT WHERE NOTED DIMENSIONS: MM



STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
100	101
200	201
500	501
1,000	102 202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500.000	504
1,000,000	105

Popular values listed in boldface. Special resistances available.

HOW TO ORDER

3319 W - 2 - 103 Model -Pin Style -

Rotor Style

-2 = Cross Slot/Single Slot Rear Adjust
-3 = 2mm Hex Thru Hole

Resistance Code -



SURFACE MOUNT 4MM SQUARE /SINGLE-TURN CERMET / INDUSTRIAL / SEALED

- Compatible with surface mount manufacturing processes
- Standoffs facilitate boardwashing and mechanical stability
- Plastic housing for RF applications
- Low profile
- Patent #5043695 assembly for seal integrity

Model 3324

B[®] Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range10 ohms to 2 megohms (see standard resistance table) Resistance Tolerance±20% std. (tighter tolerance available)

End Resistance

......1% or 3 ohms max. (whichever is greater)

Contact Resistance Variation

......3% or 3 ohms max. (whichever is greater) Resolution.....Essentially Infinite Insulation Resistance500 vdc. 100 megohms min.

Dielectric Strength Sea Level500 vac (1 minute) Adjustment Angle220° nom.

Environmental Characteristics

Soldering Heat260°C, 10 seconds, TRS ±1% Power Rating (200 volts max.) 70°C0.25 watt

<100 Ohms.....±150ppm/°C >100 Ohms±100ppm/°C Humidity.....80-98% RH,

10 cycles, 240 hours
TRS ±3%; IR 10 megohms
Vibration20G TRS ±1%; VRS ±1% Shock......100G TRS ±1%; VRS ±1% Load Life

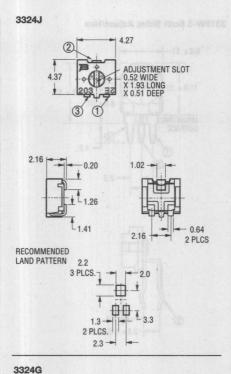
.....(@ 70°C Rated Power 1000 Hours) TRS ±3%

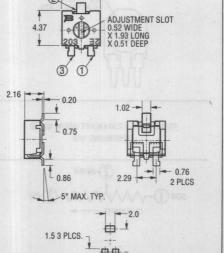
Rotational Cycling......100 cycles TRS ±3%

.....5 cycles Thermal Shock.... TRS ±2%; VRS ±1%

Physical Characteristics

Mechanical Angle	250° nom.
Torque	
Stop Strength	
WeightApp	
MarkingN	
	code and date code
WiperPosition	
Flammability	U.L. 94V-0





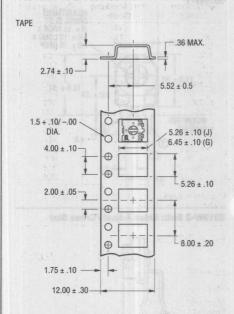
□ □ □ 5.5

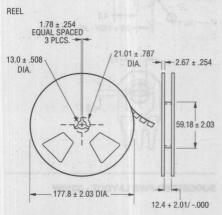
T 1.3 2 PLCS.

4.27

PACKAGING SPECIFICATIONS

Model 3319





Meets FIA specification 481

1/4" ROUND / SINGLE-TURN / CERMET

 Listed on the GPt, for style RJ50 per MIL-R-22097 and RJ450 p. Migh-Rel MiL-R-39035
 Estandard terminal college

Tage and rest packaging available (see page 61 for details)

Model 3324

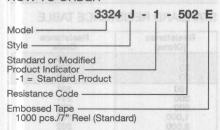
▶® Trimming Potentiometer

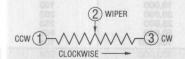
STANDARD RESISTANCE TABLE

Resistance (Ohms)	Part Marking Code	Resistance Code
10	A1	100
20	21	200
50	51	500
100	A2	101
200	22	201
500	52	501
1,000	A3	102
2,000	23	202
5,000	53	502
10,000	A4	103
20,000	24	203
50,000	54	503
100,000	A5	104
200,000	25	204
500,000	55	504
1,000,000	A6	105
2,000,000	26	205

Popular values listed in boldface. Special resistances available.

HOW TO ORDER





TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

Specifications are subject to change without notice.



1/4" ROUND / SINGLE-TURN / CERMET INDUSTRIAL / SEALED

- Listed on the QPL for style RJ50 per MIL-R-22097 and RJR50 per High-Rel MIL-R-39035
- 5 standard terminal styles

3329H

■ Tape and reel packaging available (see page 61 for details)

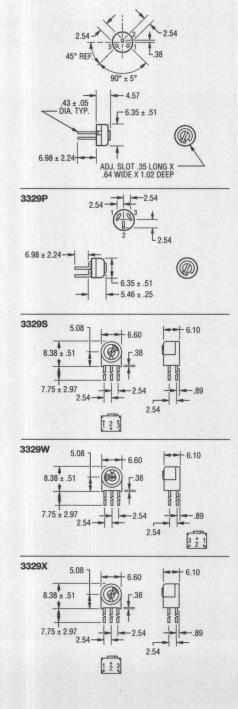
Model 3329/RJ50/RJR50

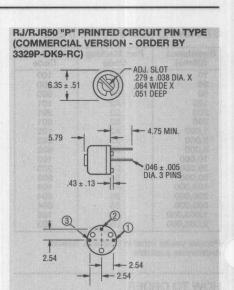
B[®] Trimming Potentiometer

Electrical Characteristics Standard Resistance Range ...10 to 1 megohm (see standard resistance table) Resistance Tolerance.....±10% std. (closer tolerance available) Absolute Minimum Resistance1% or 2 ohms (whichever is greater) Contact Resistance Variation3.0% or 3 ohms max. (whichever is greater) Adjustability Voltage±0.05% Resistance±0.15% ResolutionInfinite Dielectric Strength Sea Level......600 vac 80,000 Feet250 vac Adjustment Angle240° nom. **Environmental Characteristics** Power Rating @ 85°C (300 volts max.) 0.5 watt0.25 watt 3329.....MIL-STD-202 Method 106 96 hours (3% Δ TR, 10 Megohms IR) RJ50.....(1% Δ TR, 10 Megohms IR) RJR50.....(1% Δ TR, 100 Megohms IR) Vibration 332930G (1% ΔTR; 1% ΔVR) RJ50/RJR5020G (1% ΔTR; 1% ΔVR) Shock100G (1% ΔTR; 1% ΔVR) Shock Load Life 3329.....1,000 hours 0.5 watt @ 85°C (3% ΔTR; 3% CRV) RJ50......1,000 hours 0.25 watt @ 85°C (2% ΔTR; 1% ΔRV) RJR501,000 hours 0.25 watt @ 85°C (3% ΔTR; 1% ΔRV)200 cycles Rotational Life.....(4% ATR; 4% CRV) RJ50/RJR50(2% ΔTR) **Physical Characteristics** Mechanical Angle260° nom. Torque5.0 oz-in. max. Torque5.0 oz-in. max. Stop Strength5.0 oz -in. min. Terminals .Solderable pins 3329 RJ50/RJR50MIL-STD-202; Method 208 Weight0.02 oz. 3329.....Manufacturer's trademark, resistance code, date code, manufacturer's model number and style

RJ50/RJR50.....Mil-spec part number

WiperPositioned at 50% nominal Standard Packaging50 pcs. per tube





STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100 200 500 1,000 2,000 5,000 10,000 25,000 50,000 100,000	101 201 501 102 202 502 103 203 253 503 104
200,000	204
250,000	254
500,000	504
1,000,000	105

Popular values listed in boldface. Special resistances available.

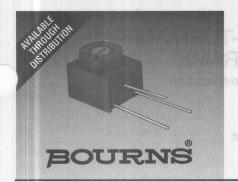


Consult factory for other available options.

Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

*"Fluorinert is a registered trademark of 3M Co.



5/16" ROUND / FOUR-TURN / CERMET INDUSTRIAL / SEALED

- Unique planetary drive offers precise wiper setting of a multiturn in a single-turn package size
- Top and side adjust styles

Model 3339

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range Resistance Tolerance±10% std. (tighter tolerance available) Absolute Minimum Resistance

.....1% or 2 ohms max. (whichever is greater) Contact Resistance Variation

......3% or 3 ohms max. (whichever is greater)

Adjustability Voltage.....±0.05% Resistance.....±0.1% Resolution.....Infinite Insulation Resistance500 vdc. 1,000 megohms min. Dielectric Strength

Sea Level600 vac 80,000 Feet.....250 vac Effective Travel.....4 turns nom.

Environmental Characteristics

Power Rating (300 volts max.)-55°C to +150°C Temperature Coefficient 96 hours (3% Δ TR, 10 Megohms IR) Vibration......30G (1% ΔTR; 1% ΔVR) Shock......100G (1% ΔTR; 1% ΔVR) Load Life

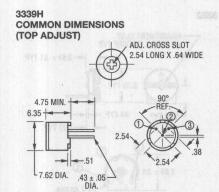
.....1,000 hours 0.5 watt @ 85°C (3% ATR; 3% or 3 ohms, whichever is greater, CRV)

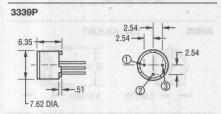
Rotational Life......200 cycles (3% ATR; 3% or 3 ohms, whichever is greater, CRV)

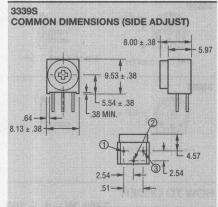
Physical Characteristics

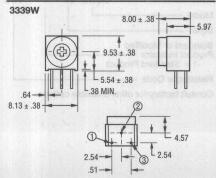
Torque3 oz-in. max. Mechanical Stops......Wiper idles TerminalsSolderable pins wiring diagram, date code, manufacturer's model number and style WiperPositioned at 50% nominal FlammabilityU.L.94V-0 Standard Packaging50 pcs. per tube

Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice. "Fluorinert is a registered trademark of 3M Co.

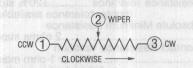








TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

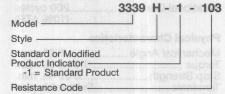


STANDARD RESISTANCE TABLE

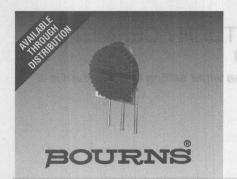
Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105

Popular values listed in boldface. Special resistances available.

HOW TO ORDER



Consult factory for other available options.



3/8" ROUND / SINGLE-TURN / CERMET INDUSTRIAL / OPEN FRAME

- Stable cermet element offers infinite resolution
- Very low profile
- Seven standard pin styles
- Thumb and screw driver adjustment

Model 3352

B[®] Trimming Potentiometer

Electrical Characteristics

Environmental Characteristics Power Rating (250 volts max.)

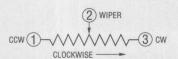
0.50 watt
0 watt
C to +125°C
2K & up
Below 2K
Method 103
96 hours

	30 Hours
	(2% Δ TR, 10 Megohms IR)
Vibration	30G (2% ATR; 2% AVR)
	100G (2% ATR; 2% AVR)
Load Life	

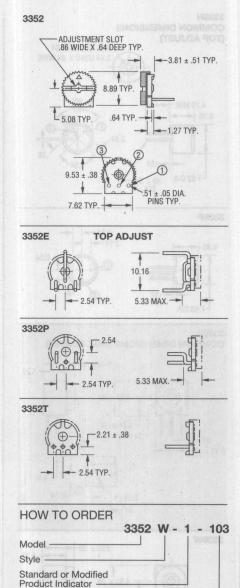
Loud Lilo	
1,000 hours (0.5 watt @ 85°C
	(3% ATR)
Rotational Life	200 cycles
	(100% ATD)

Physical Characteristics

Mechanical Angle.	250° nom.
Torque	3.0 oz-in. max.
Stop Strength	8 oz -in. min.
Terminals	Solderable pins
Weight	0.01 oz.
Marking	Manufacturer's
traden	nark, resistance value
	and model number.
Date	e code on packaging.
Wiper	Set at CW end
Standard Packagin	a



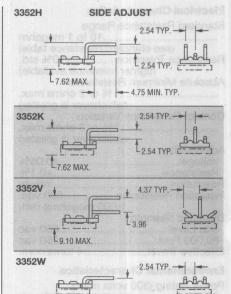
......100 pcs. per bag



-1 = Standard Product

Consult factory for other available options.

Resistance Code



TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

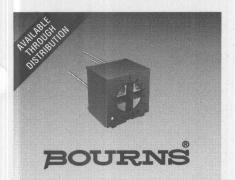
5.08 MAX. -

STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100 200 500 1,000 2,000 5,000 10,000 20,000 25,000 50,000	101 201 501 102 202 502 103 203 253 503 104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.

Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice.



1/4" SQUARE / SINGLE-TURN / CERMET INDUSTRIAL / SEALED

- Miniature package
- Rotor designed for automatic machine adjust interface
- Withstands harsh environments and immersion cleaning processes
- Available on tape and reel packaging (see page 61)

Model 3362

B[®] Trimming Potentiometer

FOR ORDERING INFORMATION, SEE FOLLOWING PAGE.

Electrical Characteristics

Standard Resistance Range (see standard resistance table)

Resistance Tolerance±10% std. (tighter tolerance available)

Absolute Minimum Resistance1% or 2 ohms

(whichever is greater) Contact Resistance Variation

......1% or 3 ohms max. (whichever is greater) Adjustability

Voltage.....±0.05% Resistance.....±0.15% Resolution......Infinite Insulation Resistance.......500 vdc. 1,000 megohms min.

Dielectric Strength Sea Level900 vac 80,000 Feet.....350 vac Adjustment Angle240° nom.

Environmental Characteristics

Power Rating (300 volts max.) 70°C0.50 watt 125°C0 watt

Temperature Range-55°C to +125°C Temperature Coefficient

±100ppm/°C Seal Test85°C Fluorinert* HumidityMIL-STD-202 Method 103 96 hours

(2% ΔTR; 10 Megohms IR) Vibration.....30G (1% ΔTR; 1% ΔVR) Shock.....100G (1% ΔTR; 1% ΔVR) Load Life

......1,000 hours 0.5 watt @ 70°C (3% ΔTR; 3% or 3 ohms, whichever is greater, CRV)

Rotational Life......200 cycles (4% Δ TR; 3% or 3 ohms,

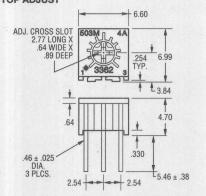
whichever is greater, CRV)

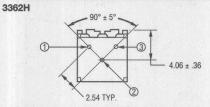
Physical Characteristics

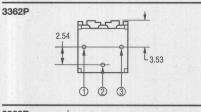
Mechanical Angle	270° nom.
	3.0 oz-in. max.
	7.0 oz -in. min.
	Solderable pins
Weight	0.02 oz.
Marking	Resistance code,
terminal num	bers, manufacturer's
	model number, style

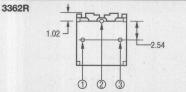
and date code WiperPositioned at 50% nominal FlammabilityU.L. 94V-0 Standard Packaging50 pcs. per tube

COMMON DIMENSIONS TOP ADJUST

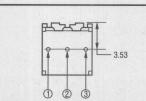




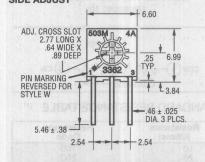


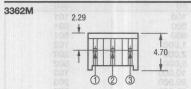


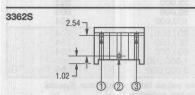
3362U

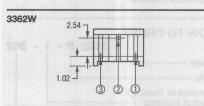


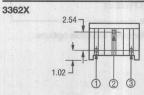
COMMON DIMENSIONS SIDE ADJUST











Common dimensions unless otherwise specified.

1/4" SQUARE / SINGLE-TURN / CERMET INDUSTRIAL / SEALED

Rotor designed for automatic machine adjust interface
 Withstands harsh environments and immersion cleaning process

EMSTUDE

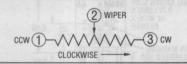
Model 3362

B[®] Trimming Potentiometer

FOR PRODUCT SPECIFICATIONS, SEE PRIOR PAGE.

TOLERANCES: ± 0.25 EXCEPT WHERE NOTED

DIMENSIONS: MM



STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100 200 500 1,000 2,000 5,000 10,000 20,000 25,000 50,000	101 201 501 102 202 502 103 203 253 503 104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.

HOW TO ORDER

Model — 3362 P - 1 - 502

Model — Style — Standard or Modified Product Indicator — 1 = Standard Product Resistance Code

Consult factory for other available options.

Rechted Characteristics

especial de la company de la c

Verhichever is greater)
Contact Fissisterion Variation
155 or 3 canne max
Verhichever is greater)

Temperature Range - 55°C to +125°C

Peet Test 1997 O'S AND TEST 19

Macking Common Angle 270° nome common and co

and date dode on the service of the

Specifications are subject to change without notice.



SMD 4MM SQUARE / SINGLE TURN CERMET / INDUSTRIAL / OPEN FRAME

- Cross-slot rotor designs suitable for automatic adjustment equipment
- Supplied in 12mm embossed tape, compatible with automatic pick-and-place assembly equipment
- Top and bottom adjust versions available Top and bottom adjust versions available Top and bottom adjust versions available
- Recommended for reflow solder processing only

Model 3364

P[®] Trimming Potentiometer

FOR ADDITIONAL STYLES, SEE FOLLOWING PAGE.

Electrical Characteristics

 >1K
 2%

 Contact Resistance Variation (Voltage Divider)
 5% max.

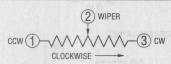
 Resolution
 Infinite

 Adjustment Angle
 260°±20°

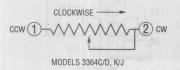
Environmental Characteristics

Physical Characteristics

TOLERANCES: ± 0.30 EXCEPT WHERE NOTED DIMENSIONS: MM



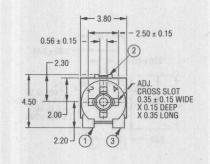
MODELS 3364W/X, U/V, A/B



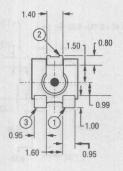
Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

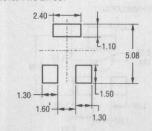
3364W, X 3-Terminal

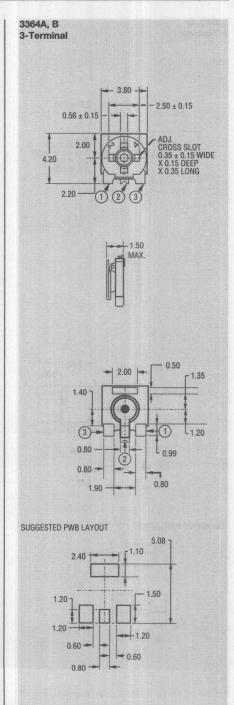






SUGGESTED PWB LAYOUT





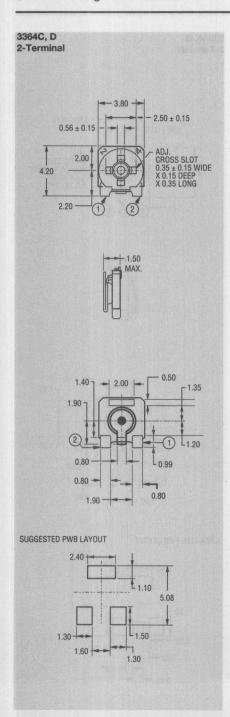
SMD 4MM SQUARE / SINGLE TURN CERMET / INDUSTRIAL / OPEN FRAME

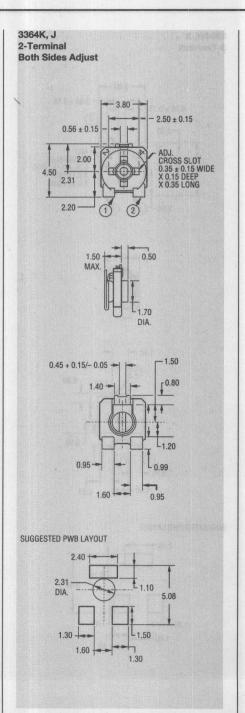
■ Choice of two packaging orientations

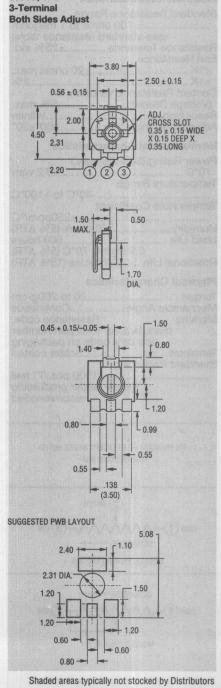
Model 3364

P® Trimming Potentiometer

FOR ADDITIONAL STYLES, SEE PRIOR PAGE.





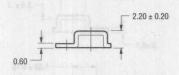


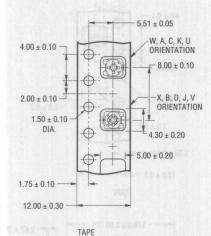
Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice:

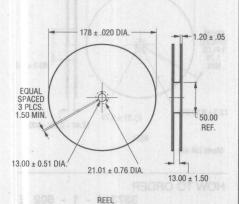
Model 3364

B[®] Trimming Potentiometer

PACKAGING SPECIFICATIONS







Conforms with EIA specification RS-481.

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code	Part Marking
100	101	12
200	201	22
500	501	52
1,000	102	13
2,000	202	23
5,000	502	53
10,000	103	14
20,000	203	24
50,000	503	54
100,000	104	15
200,000	204	25
500,000	504	55
1,000,000	105	16

Popular values listed in boldface. Special resistances available.

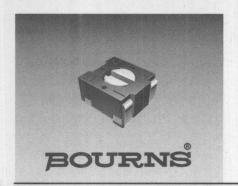
HOW TO ORDER

3364	X - 1 - 103 E
Model	
Style Orientation of parts in tape: Styles W,A,C,U,K Terminals toward sprocket	t holes
Styles X,B,D,V,J Terminals away from sproof holes	cket
Standard Product -	
Resistance Code -	
Embossed Tape Designator -	

E = 1000 pcs./7" reel (-1 standard) G = 5000 pcs./14.5" reel (-1 optional)

Consult factory for other available options.

Specifications are subject to change without notice.



SURFACE MOUNT 3MM SQUARE / SINGLE-TURN CERMET / PROCESS SEALED

- Compatible with surface mount manufacturing processes
- Rotor stop for "in-circuit" adjustment
- 5 cycle rotational and seal life
- Patent #5043695 assembly for reliable miniature construction

Model 3373

B[®] Trimming Potentiometer

Electrical Characteristics

Resolution......Essentially infinite Insulation Resistance.......500 vdc. 100 megohms min.

Environmental Characteristics

Max. Soldering Exposure260°C/5 seconds Power Rating (200 volts max.) Operating Temp. Range-55°C to +125°C Temperature Coefficient≤100 ohms ±150ppm/°C; >100 ohms ±100ppm/°C Humidity.....80-98% RH, 10 cycles, 240 hours, TRS ±3%; IR 1- megohms Vibration20G TRS ±1%; VRS ±1% Shock......100G TRS ±1%; VRS ±1%1000 hours @ 70°C Rated Power;TRS ± 5% Rotational Life100 cycles TRS ±5% Thermal Shock......5 cycles TRS ±2%; VRS ±1%

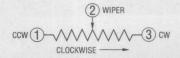
Physical Characteristics

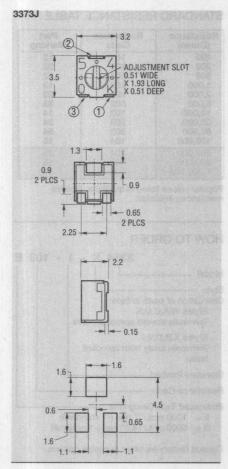
Machanical Angle

Mechanical Angle	240 110111.
Torque	100g-cm max.
Stop Strength	200g-cm typical
Weight	Approx. 0.01 oz.
Marking	
Resistance	code and date code
	oned at 50% nominal
Flammability	U.L. 94V-0
The state of the s	

0400 ---

TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM



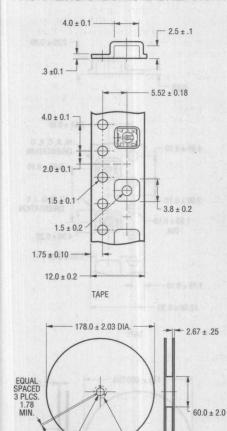


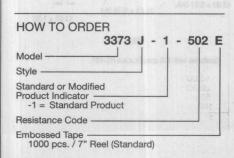
STANDARD RESISTANCE TABLE

Resistance	Part Marking	Resistance
(Ohms)	Code	Code
10 20 50 100 200 500 1,000 2,000 5,000 10,000 20,000 50,000 100,000 200,000 1,000,000 2,000,000	A1 21 51 A2 22 52 A3 23 53 A4 24 54 A5 25 55 A6 26	100 200 500 101 201 501 102 202 502 103 203 503 104 204 504 105 205

Popular values listed in boldface. Special resistances available.

PACKAGING SPECIFICATIONS





21.01 ± 0.79

REEL

12.40 + 2.00/ -.000

13.0 ± 0.50 DIA.

Meets EIA 481

Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.



SURFACE MOUNT 4MM SQUARE / SINGLE-TURN CERMET / PROCESS SEALED

- Elastomer seal allows multiple adjustments (5 rotations)
- Recommended for reflow processing only
- Cross-slot rotor design suitable for automatic adjustment equipment
- Supplied in 12mm embossed tape, compatible with automatic pick-andplace assembly equipment
- Patent #5,095,298
- Plastic rotor minimizes RF & ESD concerns

Model 3374

B[®] Trimming Potentiometer

Electrical Characteristics

Environmental Characteristics

Power Rating

70°C	0.25 watt
125°C	0 watt
Operating Temperature R	ange
	-55°C to +125°C
Temperature Coefficient	
<500K ohms	±100ppm/°C
≥500K ohms	±150ppm/°C
Seal	
HumidityMIL-STD	202 Method 103
Vibration20G: TRS	±1%, VRS ±1%
Shock100G: TRS	±1%, VRS ±1%
Load Life (@70°C Rated F	Power.
1000 hours)	
Rotational Life100 c	
Thermal Shock	
	±2%, VRS ±1%
	The state of the s

Physical Characteristics

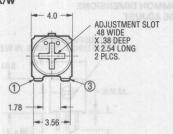
Torque	18 - 180gm/cm
Mecha	nical AngleContinuous
Markin	gManufacturer's trademark
	and part marking code
Wiper	Positioned at 50% nominal
Standa	rd Packaging750 pcs./7" reel

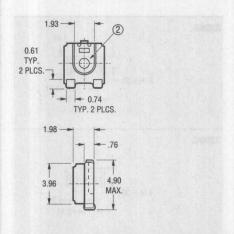
STANDARD RESISTANCE TABLE

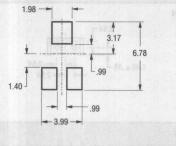
Resistance	Part Marking	Resistance
(Ohms)	Code	Code
10	A1	100
20	21	200
50	51	500
100 200 500 1,000 2,000 5,000 10,000 20,000 50,000	A2 22 52 A3 23 53 A4 24 54 A5	101 201 501 102 202 502 103 203 503 104
200,000	25	204
500,000	55	504
1,000,000	A6	105
2,000,000	26	205

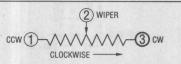
Popular values listed in boldface. Special resistances available.

3374X/W



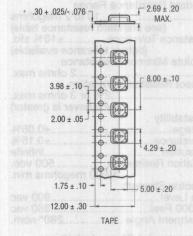


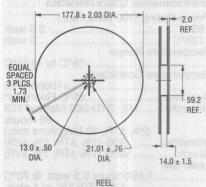




TOLERANCES: ± 0.30 EXCEPT WHERE NOTED DIMENSIONS: MM

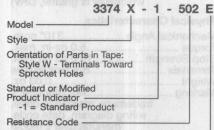
PACKAGING SPECIFICATIONS





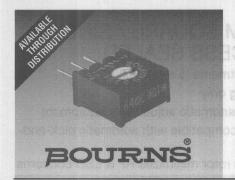
Meets EIA 481

HOW TO ORDER



Resistance Code — Embossed Tape — 750 pcs./7" reel (standard)

Consult factory for other available options.



3/8" SQUARE / SINGLE-TURN / CERMET INDUSTRIAL / SEALED

- Available on tape and reel (see page 61 for details)
- Available with a knob for finger adjust
- 15 terminal styles
- Top and side adjust types (F, P, H, W, X most popular)
- High voltage types available (see page 56 for details)

Model 3386

Bourns® Trimming Potentiometer

Electrical Characteristics

Standard Resistance Range

(see standard resistance table) Resistance Tolerance±10% std. (tighter tolerance available)

Absolute Minimum Resistance

......2 ohms max.
Contact Resistance Variation

.....2% or 3 ohms max. (whichever is greater)

Adjustability Voltage.....±0.05% Resistance.....±0.15% Resolution.....Infinite Insulation Resistance500 vdc. 1,000 megohms min.

Dielectric Strength Sea Level900 vac 70,000 Feet......350 vac Adjustment Angle280° nom.

Environmental Characteristics

Power Rating (300 volts max.) 85°C0.5 watt 125°C0 watt Temperature Range

-55°C to +125°C Temperature Coefficient

.....±100ppm/°C Seal Test85°C Fluorinert* Humidity......MIL-STD-202 Method 103

(2% ΔTR, 10 Megohms min.) Vibration......30G (1% ΔTR; 1% ΔVR) Shock.....100G (1% ΔTR; 1% ΔVR) Load Life

......1,000 hours 0.5 watt @ 70°C (3% ΔTR; 1% or 1 ohm,

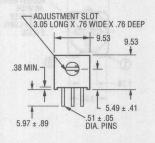
whichever is greater, CRV) Rotational Life......200 cycles (4% Δ TR; 1% or 1 ohm, whichever is greater, CRV)

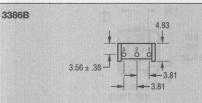
Physical Characteristics

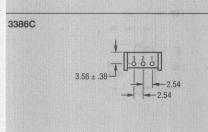
i ilysical Orial acteri.	Stics
Mechanical Angle	310° nom.
Torque	5.0 oz-in. max.
Stop Strength	15.0 oz -in. min.
Terminals	Solderable pins
Weight	
Marking	
	rk, resistance code,
	liagram, date code,
ma	anufacturer's model
	number and style
Standard Packaging	

.....50 pcs. per tube

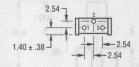
COMMON DIMENSIONS SIDE ADJUST

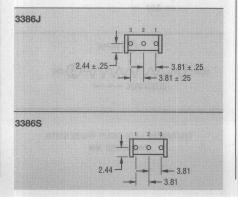




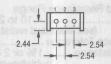


3386H

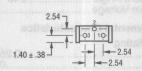




3386W



3386X



STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Popular values listed in boldface. Special resistances available.

HOW TO ORDER 3386 P -

Model -Style -Standard or Modified Product Indicator — -1 = Standard Product Resistance Code Optional Suffix Letter

- 103 T

Consult factory for other available options.

T = Knob

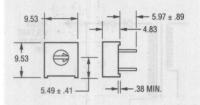
Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice. "Fluorinert" is a registered trademark of 3M Co.

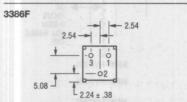
3/8" SQUARE / SINGLE-TURN / CERMET INDUSTRIAL / SEALED HIGH VOLTAGE FOOUS CONTROL

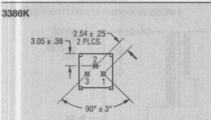
Model 3386

Bourns® Trimming Potentiometer

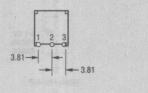
COMMON DIMENSIONS



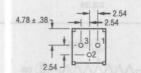


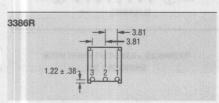






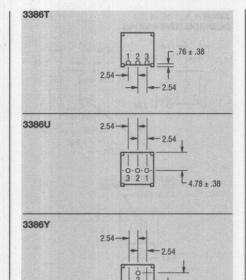
3386P





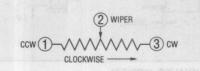
Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

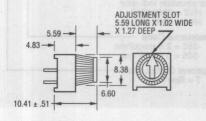


TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

3.05 ± .38



The Model 3386 is available with a knob for finger adjustment. Add suffix letter "T" to order code for F, P and X terminal styles.





3/8" SQUARE / SINGLE-TURN / CERMET INDUSTRIAL / SEALED HIGH VOLTAGE FOCUS CONTROL

- Designed for electrostatic focus control application on monochrome or color CRTs
- Rated at 1KV D.C. and 600 VDC input voltage
- High stability cermet element
- Available with optional red knob

Model 3386 HV2/3386 HV3

Bourns® Trimming Potentiometer

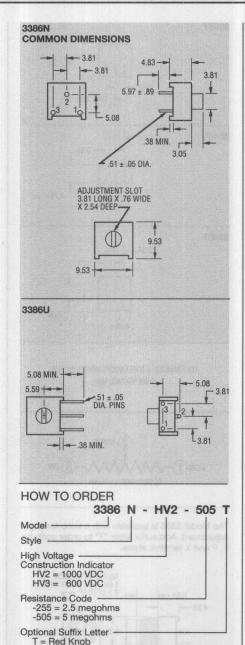
Electrical Characteristics

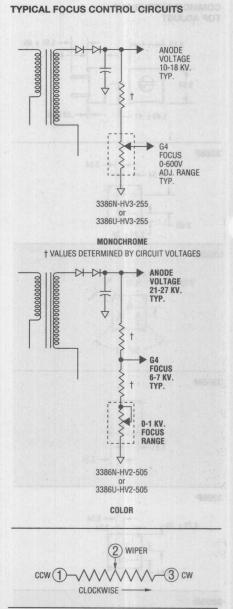
Standard Resistance Range2.5 and 5 megohms Resistance Tolerance±20% Contact Resistance Variation2% max. Adjustability Voltage Divider.....±0.05% Rheostat±0.15% Resolution.....Infinite Insulation Resistance @ 1KV D.C.1,000 megohms min. Dielectric Strength (5,000 foot altitude)

Environmental Characteristics HV2 Input Voltage 85°C(1 KVDC max.) 125°C0 watt HV3 Input Voltage 85°C(600 VDC max.) 125°C0 watt Temperature Range-55°C to +125°C Temperature Coefficient ±400ppm/°C Humidity......MIL-STD-202 Method 103240 Hours (100 megohms min. IR) Load Life HV2.....1,000 hours 1 KVDC 60°C, 90% R.H. (3% max. ΔTR)
HV31,000 hours 600 VDC
60°C, 90% R.H. (3% max. ΔTR)
Voltage Breakdown ShockNo discontinuity 100G Rotational Life200 cycles min.

Physical Characteristics

Mechanical Angle	310° nom.
Torque	5.0 oz-in. max.
Stop Strength	15.0 oz -in. min.
Terminals	Solderable pins
Weight	
Marking	Manufacturer's
	k, resistance code,
	agram, date code,
mai	nufacturer's model
	number and style
Flammability	
Standard Packaging	50 pcs. per tube





TOLERANCES: ± 0.25 EXCEPT WHERE NOTED DIMENSIONS: MM

Shaded areas typically not stocked by Distributors and not recommended for new designs. Specifications are subject to change without notice. "Fluorinert" is a registered trademark of 3M Co.



3/8" SQUARE / SINGLE-TURN / CERMET INDUSTRIAL / SEALED

- Designed for operational amplifier offset voltage adjustment applications
- Reduces power supply drift errors
- Unique center tapped trimming potentiometer
- Vertical adjust type available

Model 3386-OT1

Bourns® Trimming Potentiometer

Electrical Characteristics

Environmental Characteristics

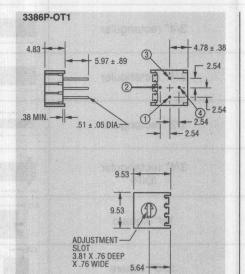
Power Rating

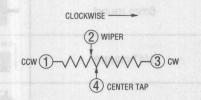
150°C 0 watt Temperature Range
55°C to +150°C Temperature Stability (ΔVR)
±0.5% max. Seal Test85°C Fluorinert* HumidityMIL-STD-202 Method 103 96 hours ±2%
Δ TR 10 Megohms min. Vibration, 30G±1% Δ TR Shock, 100G±1% Δ TR Load Life, 1,000 Hours±3% Δ TR Rotational Life, 200 cycles±4% Δ TR

Physical Characteristics

nom. max.
min.
pins
3 oz.
irer's
ode,
date
nodel
style
4V-0
/tray
-

Also see Model 3296-OT1, page 25.

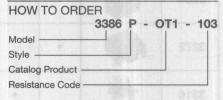




STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code		
100	101		
200	201		
500	501		
1,000	102		
2,000	202		
5,000	502		
10,000	103		
20,000	203		
50.000	503		
100,000	104		
200,000	204		
500,000	504		
1,000,000	105		

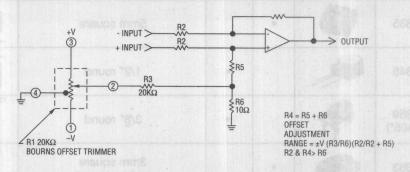
Popular values listed in boldface. Special resistances available.



TOLERANCES: ± 0.25 EXCEPT WHERE NOTED

DIMENSIONS: MM

SUGGESTED OFFSET VOLTAGE ADJUSTMENT CIRCUIT



Shaded areas typically not stocked by Distributors and not recommended for new designs.

Specifications are subject to change without notice.

*"Fluorinert" is a registered trademark of 3M Co.



OPTIONAL PRODUCTS

These optional trimmer products are not recommended for new designs. However, if you require technical specifications, you may obtain them through the Bourns FAX Library. Simply dial +818 837 4341, account #411, and request the appropriate model number.

Model B.		Mounting							
Number	Product	Surface Mount			Circuit Board Layout				
20			•	20mm rectangular (SIP)	Femula Famula Fa				
3005		DARD RE	MATE 8	3/4" rectangular					
3009	7	50 00 00 00 00 00 00 00 00	•	3/4" rectangular	5.08 - 17.78				
3082	7	# 0.000 m 0.000 m 0.000 m 0.000 m	•	1/2" rectangular					
3099	-	900 (00 900 (00 41) antifes	ELECTION .	3/4" rectangular (DIP)	9.02				
3269	Sh	TO ORDI	WOR	1/4" square	9,70				
3272	9	•	Model Styla -	.350" square	5.08				
3316	Fig	nos Code	nisiae fi	6mm round	5.08				
3323	42	A GEOMARIE ED	•	1/4" square	5.08				
3325	0	DUORIG	USFINIENTA	1/4" round	5.08				
3335	(3)	· ·		5mm square	2.54				
3345		7	88	1/2" round	5.08				
3359 (VA05*)		LARA BIRG BIOX	100 P	3/8" round	TOP ADJUST 10.16 ± .25 5.0 ± .25 ± .25 5.0 ± .25 ± .18				
3363	*			3mm square surface mount	3.6 3.6 State of the state of t				

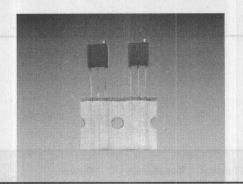
^{*}Model 3359 is known as VA05 in Europe.

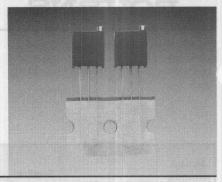


Model	Tur	Turns		Element	Resistance	Power		Mechanical	-	Temp.
Number	Single	Multi	Sealing	Tech.	Range	Rating	Tolerance	Turns	Adjust	Range
20	ilications o values	ega fouk	Sealed	Cermet	10 ohms to 5 megohms	@ 400 volts max. 70°C - 0.25 watts 150°C - 0 watt	±10%	15	Side	-55°C - +150°C
3005		• R(3	Sealed	Wirewound	10 ohms to 50K ohms	70°C - 1.0 watts 125°C - 0 watt	±10%	20	Side	-65°C - +125°C
3009	f H	r.	Sealed	Cermet	10 ohms to 5 megohms	@ 400 volts max. 70°C - 0.75 watts 150°C - 0 watt	±10%	15	Side	-55°C - +150°C
3082		T.	Sealed	Cermet	10 ohms to 2 megohms	@ 400 volts max. 85°C - 0.3 watts 150°C - 0 watt	±10%	10	Side	-65°C - +150°C
3099		3.0 = 10.	Sealed	Cermet	10 ohms to 5 megohms	@ 400 volts max. 70°C - 1.0 watts 150°C - 0 watt	±10%	20	Side	-55°C - +150°C
3269		1.0 = 100 = 01.1	Sealed	Cermet	10 ohms to 1 megohm	@ 300 volts max. 85°C - 0.25 watts 150°C - 0 watt	±10%	12 301 policet no	Top, Side	-65°C - +150°C
3272	- ня	ED AS AD B	Sealed	Cermet	100 ohms to 1 megohm	@ 300 volts max. 85°C - 0.25 watts 150°C - 0 watt	±10%	12	Side	-65°C - +150°C
3316			Open Frame	Carbon	100 ohms to 1 megohm	@ 100 volts max. 70°C - 0.1 watts	±25%	e - ±1- M S	Top, Side	-25°C - +150°C
3323	•	n o	Sealed	Cermet	20 ohms to 2 megohms	@ 300 volts max. 70°C - 0.5 watts 150°C - 0 watt	±20%	1	Top, Side	-55°C - +125°C
3325	1 1 1 1 1 1		Sealed	Cermet	10 ohms to 1 megohm	@ 300 volts max. 85°C - 0.5 watts 150°C - 0 watt	±10%	fenfi A squ 1 2 saft amm anematos ylap	Top, Side	-55°C - +150°C
3335	وأأو		Sealed	Cermet	10 ohms to 500K ohms	@ 100 volts max. 85°C - 0.2 watts 150°C - 0 watt	±20%	1	Тор	-55°C - +150°C
3345	9.10		Sealed	Wirewound	10 ohms to 50K ohms	70°C - 1.0 watts 150°C - 0 watt	±5%	1	Top, Side	-55°C - +150°C
3359 (VA05)	•	9/± 0.9 70 ± 9.92 ± 0.2	Open Frame	Cermet	100 ohms to 2 megohms	@ 250 volts max. 70°C - 0.5 watts 125°C - 0 watt	±20%	1	Top, Side	-65°C - +125°C
3363	12.	030 sa s 86 a	Open Frame	Cermet	100 ohms to 1 megohm	@ 50 VDC max. 70°C - 0.1 watts	±25%	1	Тор	-55°C - +125°C

BOURNS® POTENTIOMETER TAPE AND REEL PACKAGING **SPECIFICATIONS**

BOURNS





Model 3266*

Product specifications and standard resistance values, page 20.

+ 12.70 REF

SIDE ADJUST

3266Z-1-(RC)R

24.9 + .76

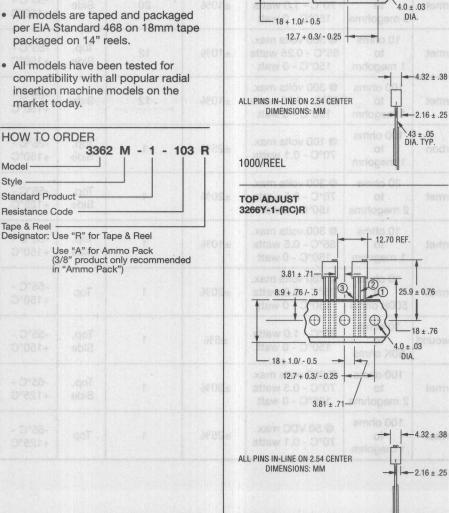
 $3.81 \pm .71$

Model 3296*

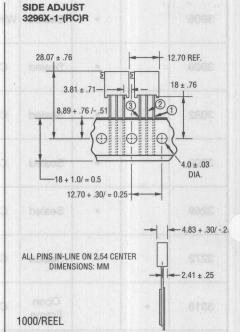
Product specifications and standard resistance values, page 23.

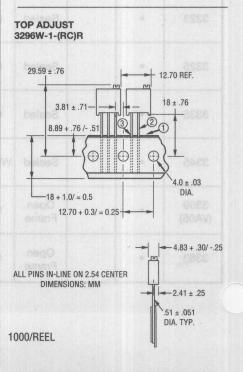
Now there is a full assortment of Trimpot® Potentiometer models on tape and reel.

- · Assembly speed is up to 10X faster because radial insertion equipment can place over 100 components a minute!
- · Assembly cost reduction is up to 75% because automatic insertion eliminates errors.
- insertion machine models on the

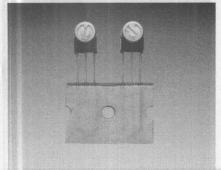


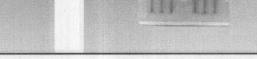
1000/REEL

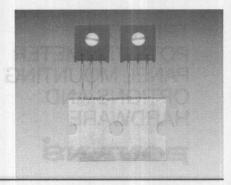




Specifications are subject to change without notice. *Patented models.







Model 3329

Product specifications and standard resistance values, page 44.

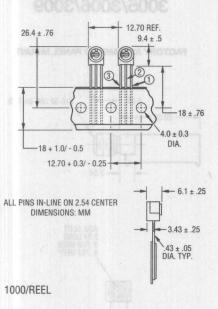
Model 3362

Product specifications and standard resistance values, pages 47 & 48.

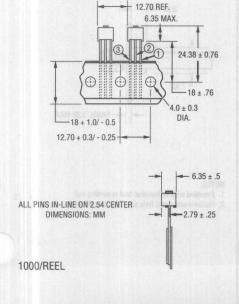
Model 3386

Product specifications and standard resistance values, pages 54 & 55.

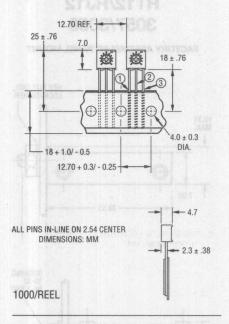
SIDE ADJUST 3329M-1-(RC)R

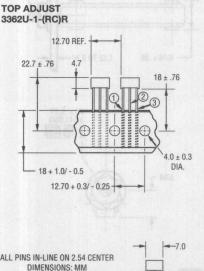


TOP ADJUST 3329U-1-(RC)R



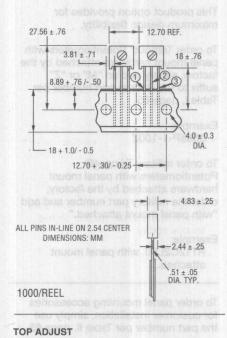
SIDE ADJUST 3362M-1-(RC)R



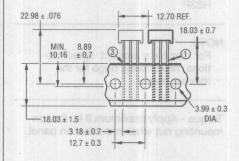


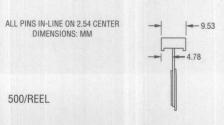
ALL PINS IN-LINE ON 2.54 CENTER DIMENSIONS: MM -3.56 ± .38 750/REEL

SIDE ADJUST 3386W-1-(RC)R



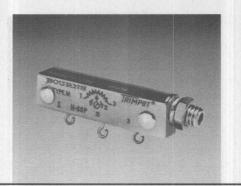
3386U-1-(RC)R

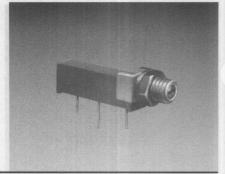




TRIMPOT® **POTENTIOMETER** PANEL MOUNTING **OPTIONS AND** HARDWARE

BOURNS





FACTORY INSTALLED PANEL MOUNT

FACTORY INSTALLED PANEL MOUNT

Many Trimpot® Potentiometers are available for panel mount application.

This product option provides for maximum design flexibility.

To order Trimpot® Potentiometers with panel mount hardware attached by the factory, simply add an "M" or "Z' suffix to the Bourns part number per Table I, page 65.

Example: 3005P-1-100Z

To order military Trimpot® Potentiometers with panel mount hardware attached by the factory, order the military part number and add "with panel mount attached."

Example:

RT12C2L00, with panel mount attached.

To order panel mounting accessories for customer installation, simply use the part number per Table II, page 65.

Example: H83P

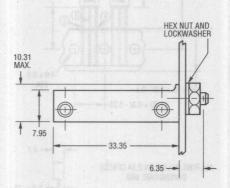
NOTE:

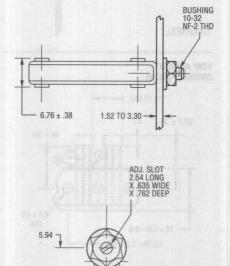
For complete product specifications, see catalog page for the trimmer model.

Torque - Apply maximum 8 in. lbs. on mounting nut when mounted on panel.

Models RT12/RJ12 3057/3059

FACTORY ASSEMBLED PANEL MOUNT



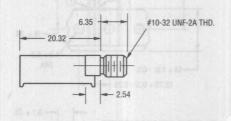


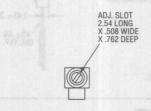
NOTES:

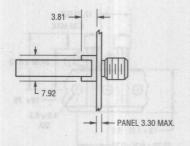
- 1. Provided with lockwasher and mounting nut.
- 2. Recommend panel holes. #10 drill (.194).

Models 3005/3006/3009

FACTORY ASSEMBLED PANEL MOUNT







NOTES:

- 1. Provided with lockwasher and mounting nut.
- 2. Recommend panel hole size .200 dia. (#7 drill).



FACTORY INSTALLED PANEL MOUNT



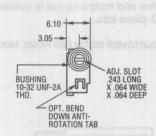
FACTORY INSTALLED PANEL MOUNT

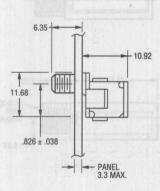


FACTORY INSTALLED PANEL MOUNT

Models 3292/RJR24 X, L and W Styles ("L" Style Not Available on RJR24)

FACTORY ASSEMBLED PANEL MOUNT

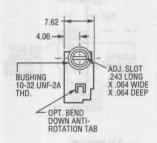


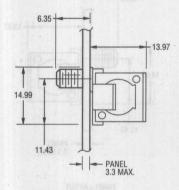


NOTES:
1. Provided with lockwasher and mounting nut.

Models RT22/RTR22/RJ22 3250/3252

FACTORY ASSEMBLED PANEL MOUNT



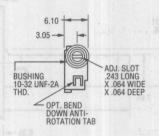


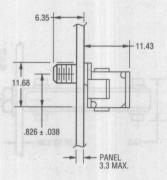


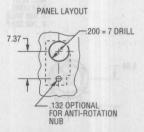
NOTES:
1. Provided with lockwasher and mounting nut.

Models
RT24/RTR24/3290
H and W Styles - 3290
X & W Styles-RT24/RTR24

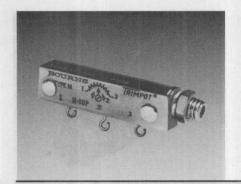
FACTORY ASSEMBLED PANEL MOUNT

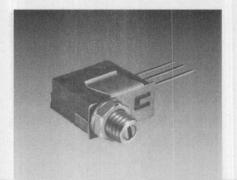


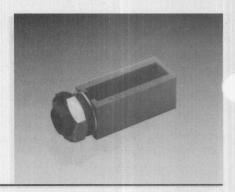




NOTES:
1. Provided with lockwasher and mounting nut.







H-58P PANEL MOUNT **UNSEALED***

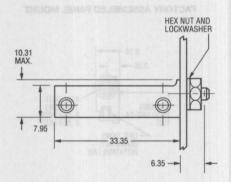
H-65P PANEL MOUNT **UNSEALED***

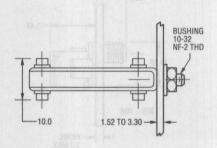
H-83P PANEL MOUNT **UNSEALED***

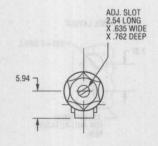
SEE TABLE II (PAGE 65) FOR PANEL MOUNT PART NUMBER

1-1/4 INCH RECTANGULAR **MULTITURN MODELS**

CUSTOMER INSTALLED PANEL MOUNT



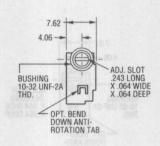


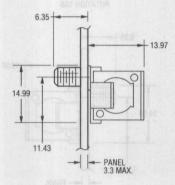


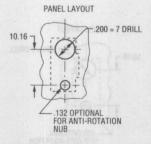
- 1. Provided with lockwasher and mounting nut.
- 2. Recommend panel holes. #10 drill (.194).

1/2 INCH SQUARE **MULTITURN MODELS**

CUSTOMER INSTALLED PANEL MOUNT





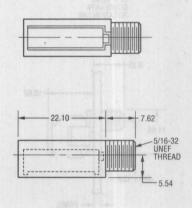


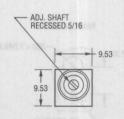
Provided with lockwasher and mounting nut.
 Drawings shown with trimmer. Order part separately.

ADAPTER FOR **MODELS 3005 AND 3006**

The H-83P Adapter is used with Models 3005 (page 58) and 3006 (page 9). Order separately and simply snap fit the trimmer in the plastic case. The H-83P with lockwasher and mounting nut is available in 50-piece lots.

CUSTOMER INSTALLED PANEL MOUNT





NOTES:
1. Drawings shown with trimmer. Order part separately.

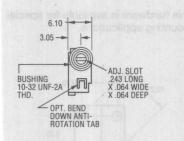
*Specify H82 if panel seal is required. Specifications are subject to change without notice.

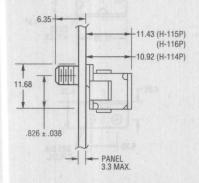


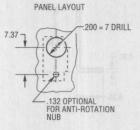
H-114P/H-115P/H-116P PANEL MOUNT

3/8 INCH SQUARE MULTITURN MODELS

CUSTOMER INSTALLED PANEL MOUNT







NOTES:
1. Provided with lockwasher and mounting nut.
2. Drawings shown with trimmer. Order part separately.

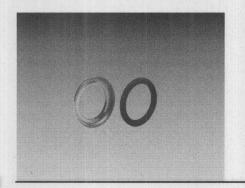
TABLE I FACTORY INSTALLED PANEL MOUNTS

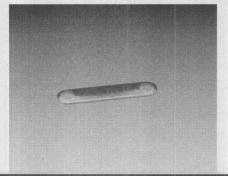
STANDARD PART NO.	PART NO. WITH PANEL MOUNT
3005P-1-(RC)	3005P-1-(RC) Z
3006P,Y, or W-1-(RC)	3006P,Y, or W-1-(RC) Z
3009P or Y-1-(RC)	3009P or Y-1-(RC) Z
3057L,J,P, or Y-1-(RC)	3057L,J,P, or Y-1-(RC) M
3059L,J,P, or Y-1-(RC)	3059L,J,P, or Y-1-(RC) M
3250L or W-1-(RC)	3250L or W-1-(RC) M
3252L or W-1-(RC)	3252L or W-1-(RC) M
3290 H or W-1-(RC)	3290H or W-1-(RC) M
3292L,W, or X-1-(RC)	3292L,W, or X-1-(RC) M

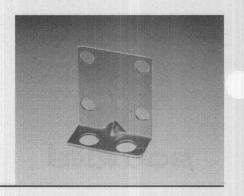
TABLE II
RETRO-FIT PANEL MOUNTS FOR INSTALLATION BY CUSTOMER

STANDARD PART NO.	ORDER PANEL MOUNT PART NO.			
3005P-1-(RC)	H-83P			
3006P,Y, or W-1-(RC)	H-83P			
3057L,J,P, or Y-1-(RC)	H-58P* SCREWED/H43P RIVETED			
3059L,J,P, or Y-1-(RC)	H-58P* SCREWED/H43P RIVETED			
3250L, W, X-(RC)	H-65P-1*			
3252L or W-1-(RC)	H-65P-3*			
3252X-1-(RC)	H-65P-5*			
3290 H or W-1-(RC)	H-114P*			
3292L-1-(RC)	H-115P*			
3292W OR X-1-(RC)	H-116P*			
RT12P,Y,L	H-58P* SCREWED/H43P RIVETED			
RJ12L,P,Y	H-58P* SCREWED/H43P RIVETED			
RT22L,W, X, RTR22L,W, X	H-65P-1*			
RJ22L,W	H-65P-3*			
RJ22X	H-65P-5*			
RT24W / RTR24W OR X	H-114P*			
RJR24W OR X	H-116P*			

^{*}Specify H-82 if panel seal is required.







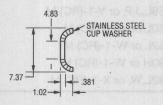
H-82

H-25/H-28

H-26S

PANEL SEAL FOR ALL PANEL MOUNTS WITH SIZE 10-32 BUSHINGS

This hardware is available for special mounting applications.





To be used with the following to provide panel seal:

H-58P

H-65P-1

H-65P-3

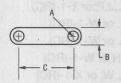
H-65P-5

H-114P H-115P

H-116P

STACKING STRAPS FOR MODELS 3250, 3252 (H-25) AND 3292 (H-28)

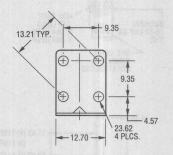
This hardware is available for special mounting applications.

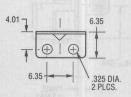


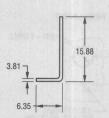
DIMENSIONS	H-25	H-28
A	.093 (.236)	<u>.070</u> (.178)
В	.143 (.363)	.125 (.318)
С	.520 (1.321)	<u>.419</u> (1.064)
THICKNESS		02 51)

SIDE BRACKET FOR MODELS 3250 AND 3252

This hardware is available for special mounting applications.







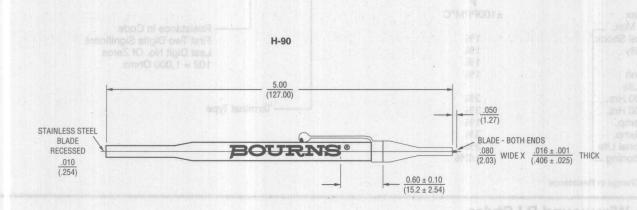


ADJUSTMENT TOOLS

- Meets UL 94V-0
- Pocket clip
- For use on most trimmer shafts/rotors
- Recessed end for use with extended shafts

Model H-90/H-91

Bourns® Adjustment Tools



STAINLESS STEEL

BLADE

RECESSED

.010
(.254)

BLADE

.090
WIDE X
.018
.018
.055
(1.40)

BLADE
.055
(1.40)

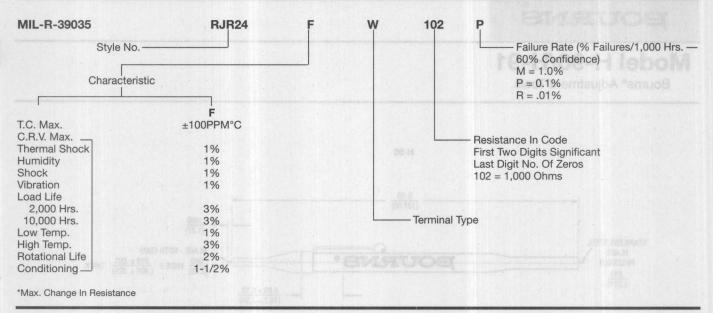
*H-91 RECOMMENDED FOR USE WITH TRIMMER MODELS 3224 AND 3214.

H-91*

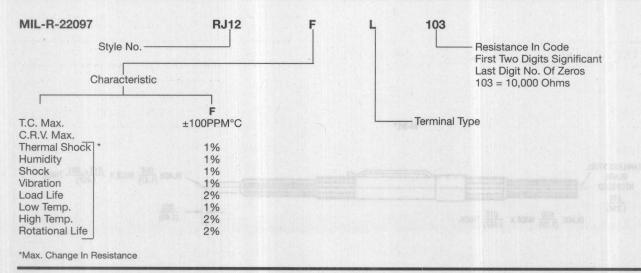


MIL-SPEC NUMBERING SYSTEM Explanation of System

Non-Wirewound RJR Styles - High Reliability

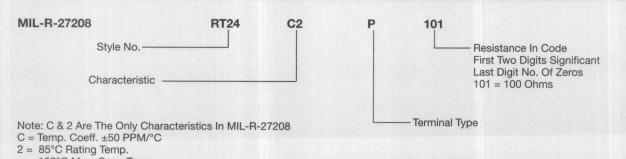


Non-Wirewound RJ Styles



Wirewound RT Styles

150°C Max. Oper. Temp.





HOW TO ORDER GUIDE Mil-Spec Part Numbers

High-Rel Wirewound Specification MIL-R-39015 RTR Styles

This specification has a procedure for ordering, processing, and marking parts entirely different than the other three specifications. IT DOES NOT USE THE TYPE DESIGNATION NUMBER AS THE PART NUMBER.

THE NUMBER TO ORDER BY CONSISTS OF:

- The individual specification sheet number M39015/2 (FOR STYLE RTR22) M39015/3 (FOR STYLE RTR24)
- A dash number from the specification sheet table for the resistance value

M390	15/2	M39015/3
-003	500	- 006 500
-004	1K	-007 1K
-005	2K	-008 2K
-006	5K	-009 5K
-007	10K	-010 10K
-008	20K	

3. Terminal Type

4. Failure rate level M, P or R

M = 1%

P = 0.1%

R = 0.01%

% FAILURE/1,000 Hrs. - 60% Confidence

EXAMPLES OF PART NUMBERS

M39015/2 - 006LP

5K Term. Type L — Failure Rate P

M39015/3 - 010XR

10K Term. Type X — Failure Rate R

The table below shows all part numbers covered by this specification, the conversion to the RTR type designation number required by the supplier to manufacture the part, and the number that will be marked on the units you receive (same as part number ordered but with the letter "J" in front of it). The letter "J" is a government mark and it is certification that the parts comply with the specification.

INFORMATION NOTES

1. M39015/3 was added to the Mil-Spec after its original release.

Bourns High Reliability Mil-Spec Part Numbers

Order By	Process By*	Marked With	Terminal Types	Failure Rates
M39015/2-003(TS)(FR)	RTR22D(TS)501(FR)	JM39015/2-003(TS)(FR)	#72402P200 RT240 #72402P200 RT240	
M39015/2-004(TS)(FR)	RTR22D(TS)102(FR)	JM39015/2-004(TS)(FR)	1124C2P1Q† FEEK	
M39015/2-005(TS)(FR)	RTR22D(TS)202(FR)	JM39015/2-005(TS)(FR)	TRACEPBOT NTEST	
FTG240X5C21 6.69	PO 4D02007 PTT24DW5027	2:W602	L, P, W, X	M, P
M39015/2-006(TS)(FR)	RTR22D(TS)502(FR)	JM39015/2-006(TS)(FR)	INCACRP103 - RT24	
M39015/2-007(TS)(FR)	RTR22D(TS)103(FR)	JM39015/2-007(TS)(FR)		
M39015/2-008(TS)(FR)	RTR22D(TS)203(FR)	JM39015/2-008(TS)(FR)	eroial Model 3260)	126 (Comm
M39015/3-006(TS)(FR)	RTR24D(TS)501(FR)	JM39015/3-006(TS)(FR)	P, W, X	M, P
M39015/3-007(TS)(FR)	RTR24D(TS)102(FR)	JM39015/3-007(TS)(FR)	PTZBCZW200	00 00
M39015/3-008(TS)(FR)	RTR24D(TS)202(FR)	JM39015/3-008(TS)(FR)	TO TWO DESCRIPTION OF THE PROPERTY OF THE PROP	
M39015/3-009(TS)(FR)	RTR24D(TS)502(FR)	JM39015/3-009(TS)(FR)	P, W, X	M, P, R
M39015/3-010(TS)(FR)	RTR24D(TS)103(FR)	JM39015/3-010(TS)(FR)	SUCWSUS(IR	

NOTE: See individual model pages for Bourns qualified resistance values.

*May also order using this part number.

Specifications are subject to change without notice.



QUALIFIED PART NUMBERS

Bourns reserves the right per MIL-R-39035 to substitute a higher grade temperature characteristic or failure rate (QPL) than requested.

RT12 (Commercial Model 3057)

STD. VALUES OHMS		NOMINAL		
	L	Р	Y= 1%	(PERCENT)
10	RT12C2L100	RT12C2P100	RT12C2Y100	2.40
20	RT12C2L200	RT12C2P200	RT12C2Y200	1.90
50	RT12C2L500	RT12C2P500	RT12C2Y500	1.40
100	RT12C2L101	RT12C2P101	RT12C2Y101	1.00
200	RT12C2L201	RT12C2P201	RT12C2Y201	0.86
500	RT12C2L501	RT12C2P501	RT12C2Y501	0.89
1K	RT12C2L102	RT12C2P102	RT12C2Y102	0.72
2K	RT12C2L202	RT12C2P202	RT12C2Y202	0.58
5K	RT12C2L502	RT12C2P502	RT12C2Y502	0.43
10K	RT12C2L103	RT12C2P103	RT12C2Y103	0.39
20K	RT12C2L203	RT12C2P203	RT12C2Y203	0.31

RT/RTR22 (Commercial Model 3250)

STD.		FIGURE RT22C2			RTR22D				NOMINAL
VALUES L	bers dovere	mun Pag lla	w w	sideX adT	L	Р	W	X	(PERCENT)
10	TIR type det	ed to the	evnoc-ent in	specificatio			- 000		- 1
20	and an department	ons attachen	es with our brook	man redressin			- 009 - 6K	- NO.	300-
50	RT22C2L500	RT22C2P500	RT22C2W500	RT22C2X500	-2100	-	Nint- nin'-	The Assessment of the Control of the	0.80
100	RT22C2L101	RT22C2P101	RT22C2W101	RT22C2X101		-	WALL RING		0.90
200	RT22C2L201	RT22C2P201	RT22C2W201	RT22C2X201	- 1		-13	4000 E	0.70
500	RT22C2L501	RT22C2P501	RT22C2W501	RT22C2X501	RTR22DL501*	RTR22DP501*	RTR22DW501*	RTR22DX501*	0.60
1K	RT22C2L102	RT22C2P102	RT22C2W102	RT22C2X102	RTR22DL102*	RTR22DP100*	RTR22DW102*	RTR22DX102*	0.40
2K	RT22C2L202	RT22C2P202	RT22C2W202	RT22C2X202	RTR22DL202*	RTR22DP202*	RTR22DW202*	RTR22DX202*	0.30
5K	RT22C2L502	RT22C2P502	RT22C2W502	RT22C2X502	RTR22DL502*	RTR22DP502*	RTR22DW502*	RTR22DX502*	0.25
10K	RT22C2L103	RT22C2P103	RT22C2W103	RT22C2X103	RTR22DL103*	RTR22DP103*	RTR22DW103*	RTR22DX103*	0.19
20K	RT22C2L203	RT22C2P203	RT22C2W203	RT22C2X203	RTR22DL203*	RTR22DP203*	RTR22DW203*	RTR22DX203*	0.16

RT/RTR24 (Commercial Model 3290)

STD. VALUES OHMS	RT24C2				NOMINAL		
	P	w	x	Р	w	х	(PERCENT)
10	RT24C2P100	RT24C2W100	RT24C2X100		- 0		1.11
20	RT24C2P200	RT24C2W200	RT24C2X200				0.93
50	RT24C2P500	RT24C2W500	RT24C2X500	50 (FFR) - J	STRUCCHIEF	003/TSMFR) -	0.62
100	RT24C2P101	RT24C2W101	RT24C2X101				0.60
200	RT24C2P201	RT24C2W201	RT24C2X201	L L (HI)SUB	SECTION HERE	(H4)(ET)+00	0.54
500	RT24C2P501	RT24C2W501	RT24C2X501	RTR24DP501*	RTR24DW501*	RTR24DX501*	0.42
1K	RT24C2P102	RT24C2W102	RT24C2X102	RTR24DP102*	RTR24DW102*	RTR24DX102*	0.33
2K	RT24C2P202	RT24C2W202	RT24C2X202	RTR24DP202*	RTR24DW202*	RTR24DX202*	0.26
5K	RT24C2P502	RT24C2W502	RT24C2X502	RTR24DP502*	RTR24DW502*	RTR24DX502*	0.20
10K	RT24C2P103	RT24C2W103	RT24C2X103	RTR24DP103*	RTR24DW103*	RTR24DX103*	0.17

RT26 (Commercial Model 3260)

STD. VALUES OHMS	RT26C2	NOMINAL	
	w W.G	x	(PERCENT)
10	RT26C2W100	RT26C2X100	1.90
20	RT26C2W200	RT26C2X200	1.50
50	RT26C2W500	RT26C2X500	1.25
100	RT26C2W101	RT26C2X101	1.00
200	RT26C2W201	RT26C2X201	0.94
500	RT26C2W501	RT26C2X501	0.58
1K	RT26C2W102	RT26C2X102	0.50
2K	RT26C2W202	RT26C2X202	0.45
5K	RT26C2W502	RT26C2X502	0.34

^{*}Last letter in number is failure rate level. M = 1.0% P = 0.1% R = 0.01%

¹For replacement purpose only. Not for new design.



QUALIFIED PART NUMBERS

Bourns reserves the right per MIL-R-39035 to substitute a higher grade temperature characteristic or failure rate (QPL) than requested.

RJ12 (Commercial Model 3059)

STD.	RJ12C_		RJ12F	
VALUES OHMS	Р 🚻	Y	Р	Y
10	RJ12CP100	RJ12CY100	RJ12FP100	RJ12FY100
20	RJ12CP200	RJ12CY200	RJ12FP200	RJ12FY200
50	RJ12CP500	RJ12CY500	RJ12FP500	RJ12FY500
100	RJ12CP101	RJ12CY101	RJ12FP101	RJ12FY101
200	RJ12CP201	RJ12CY201	RJ12FP201	RJ12FY201
500	RJ12CP501	RJ12CY501	RJ12FP501	RJ12FY501
1K	RJ12CP102	RJ12CY102	RJ12FP102	RJ12FY102
2K	RJ12CP202	RJ12CY202	RJ12FP202	RJ12FY202
5K	RJ12CP502	RJ12CY502	RJ12FP502	RJ12FY502
10K	RJ12CP103	RJ12CY103	RJ12FP103	RJ12FY103
20K	RJ12CP203	RJ12CY203	RJ12FP203	RJ12FY203
25K	RJ12CP253	RJ12CY253	RJ12FP253	RJ12FY253
50K	RJ12CP503	RJ12CY503	RJ12FP503	RJ12FY503
100K	RJ12CP104	RJ12CY104	RJ12FP104	RJ12FY104
1200K	RJ12CP204	RJ12CY204	RJ12FP204	RJ12FY204
250K	RJ12CP254	RJ12CY254	RJ12FP254	RJ12FY254
500K	RJ12CP504	RJ12CY504	RJ12FP504	RJ12FY504
1 MEG	RJ12CP105	RJ12CY105	RJ12FP105	RJ12FY105

RJ22 (Commercial Model 3252)

STD. VALUES		RJ22C			RJ22F				
OHMS	Lasta Lasta	Passan	W	X	Malick Gor	De LA Poerwo	W	X	
10	RJ22CL100	RJ22CP100	RJ22CW100	RJ22CX100	RJ22FL100	RJ22FP100	RJ22FW100	RJ22FX100	
20	RJ22CL200	RJ22CP200	RJ22CW200	RJ22CX200	RJ22FL200	RJ22FP200	RJ22FW200	RJ22FX200	
50	RJ22CL500	RJ22CP500	RJ22CW500	RJ22CX500	RJ22FL500	RJ22FP500	RJ22FW500	RJ22FX500	
100	RJ22CL101	RJ22CP101	RJ22CW101	RJ22CX101	RJ22FL101	RJ22FP101	RJ22FW101	RJ22FX10	
200	RJ22CL201	RJ22CP201	RJ22CW201	RJ22CX201	RJ22FL201	RJ22FP201	RJ22FW201	RJ22FX20	
500	RJ22CL501	RJ22CP501	RJ22CW501	RJ22CX501	RJ22FL501	RJ22FP501	RJ22FW501	RJ22FX50	
1K	RJ22CL102	RJ22CP102	RJ22CW102	RJ22CX102	RJ22FL102	RJ22FP102	RJ22FW102	RJ22FX102	
2K	RJ22CL202	RJ22CP202	RJ22CW202	RJ22CX202	RJ22FL202	RJ22FP202	RJ22FW202	RJ22FX202	
5K	RJ22CL502	RJ22CP502	RJ22CW502	RJ22CX502	RJ22FL502	RJ22FP502	RJ22FW502	RJ22FX502	
10K	RJ22CL103	RJ22CP103	RJ22CW103	RJ22CX103	RJ22FL103	RJ22FP103	RJ22FW103	RJ22FX103	
20K	RJ22CL203	RJ22CP203	RJ22CW203	RJ22CX203	RJ22FL203	RJ22FP203	RJ22FW203	RJ22FX203	
25K	RJ22CL253	RJ22CP253	RJ22CW253	RJ22CX253	RJ22FL253	RJ22FP253	RJ22FW253	RJ22FX253	
50K	RJ22CL503	RJ22CP503	RJ22CW503	RJ22CX503	RJ22FL503	RJ22FP503	RJ22FW503	RJ22FX503	
100K	RJ22CL104	RJ22CP104	RJ22CW104	RJ22CX104	RJ22FL104	RJ22FP104	RJ22FW104	RJ22FX104	
250K	RJ22CL254	RJ22CP254	RJ22CW254	RJ22CX254	RJ22FL254	RJ22FP254	RJ22FW254	RJ22FX25	
500K	RJ22CL504	RJ22CP504	RJ22CW504	RJ22CX504	RJ22FL504	RJ22FP504	RJ22FW504	RJ22FX504	
1 MEG	RJ22CL105	RJ22CP105	RJ22CW105	RJ22CX105	RJ22FL105	RJ22FP105	RJ22FW105	RJ22FX105	

RJ24 (Commercial Model 3296)

STD. VALUES		RJ24C			RJ24F	
OHMS	Р	W	X	Р	W	X
10	RJ24CP100	RJ24CW100	RJ24CX100	RJ24FP100	RJ24FW100	RJ24FX100
20	RJ24CP200	RJ24CW200	RJ24CX200	RJ24FP200	RJ24FW200	RJ24FX200
50	RJ24CP500	RJ24CW500	RJ24CX500	RJ24FP500	RJ24FW500	RJ24FX500
100	RJ24CP101	RJ24CW101	RJ24CX101	RJ24FP101	RJ24FW101	RJ24FX101
200	RJ24CP201	RJ24CW201	RJ24CX201	RJ24FP201	RJ24FW201	RJ24FX201
500	RJ24CP501	RJ24CW501	RJ24CX501	RJ24FP501	RJ24FW501	RJ24FX50
1K	RJ24CP102	RJ24CW102	RJ24CX102	RJ24FP102	RJ24FW102	RJ24FX102
2K	RJ24CP202	RJ24CW202	RJ24CX202	RJ24FP202	RJ24FW202	RJ24FX202
5K	RJ24CP502	RJ24CW502	RJ24CX502	RJ24FP502	RJ24FW502	RJ24FX502
10K	RJ24CP103	RJ24CW103	RJ24CX103	RJ24FP103	RJ24FW103	RJ24FX103
20K	RJ24CP203	RJ24CW203	RJ24CX203	RJ24FP203	RJ24FW203	RJ24FX203
25K	RJ24CP253	RJ24CW253	RJ24CX253	RJ24FP253	RJ24FW253	RJ24FX253
50K	RJ24CP503	RJ24CW503	RJ24CX503	RJ24FP503	RJ24FW503	RJ24FX503
100K	RJ24CP104	RJ24CW104	RJ24CX104	RJ24FP104	RJ24FW104	RJ24FX104
250K	RJ24CP254	RJ24CW254	RJ24CX254	RJ24FP254	RJ24FW254	RJ24FX254
500K	RJ24CP504	RJ24CW504	RJ24CX504	RJ24FP504	RJ24FW504	RJ24FX504
1 MEG	RJ24CP105	RJ24CW105	RJ24CX105	RJ24FP105	RJ24FW105	RJ24FX105

^{*}Last letter in number is failure rate level. M = 1.0% $\,$ P = 0.1% $\,$ R = 0.01% $\,$ For replacement purpose only. Not for new design.



QUALIFIED PART NUMBERS

Bourns reserves the right per MIL-R-39035 to substitute a higher grade temperature characteristic or failure rate (QPL) than requested.

RJR24 (Commercial Model 3292)

STD.		RJR24C		RJR24F					
VALUES OHMS	Р	W	X	Р	W	X			
10	RJR24CP100*	RJR24CW100*	RJR24CX100*	RJR24FP100*	RJR24FW100*	RJR24FX100			
20	RJR24CP200*	RJR24CW200*	RJR24CX200*	RJR24FP200*	RJR24FW200*	RJR24FX200			
50	RJR24CP500*	RJR24CW500*	RJR24CX500*	RJR24FP500*	RJR24FW500*	RJR24FX500			
100	RJR24CP101*	RJR24CW101*	RJR24CX101*	RJR24FP101*	RJR24FW101*	RJR24FX101			
200	RJR24CP201*	RJR24CW201*	RJR24CX201*	RJR24FP201*	RJR24FW201*	RJR24FX201			
500	RJR24CP501*	RJR24CW501*	RJR24CX501*	RJR24FP501*	RJR24FW501*	RJR24FX501			
1K	RJR24CP102*	RJR24CW102*	RJR24CX102*	RJR24FP102*	RJR24FW102*	RJR24FX102			
2K	RJR24CP202*	RJR24CW202*	RJR24CX202*	RJR24FP202*	RJR24FW202*	RJR24FX202			
5K	RJR24CP502*	RJR24CW502*	RJR24CX502*	RJR24FP502*	RJR24FW502*	RJR24FX502			
10K	RJR24CP103*	RJR24CW103*	RJR24CX103*	RJR24FP103*	RJR24FW103*	RJR24FX103			
20K	RJR24CP203*	RJR24CW203*	RJR24CX203*	RJR24FP203*	RJR24FW203*	RJR24FX203			
25K	RJR24CP253*	RJR24CW253*	RJR24CX253*	RJR24FP253*	RJR24FW253*	RJR24FX253			
50K	RJR24CP503*	RJR24CW503*	RJR24CX503*	RJR24FP503*	RJR24FW503*	RJR24FX503			
100K	RJR24CP104*	RJR24CW104*	RJR24CX104*	RJR24FP104*	RJR24FW104*	RJR24FX104			
250K	RJR24CP254*	RJR24CW254*	RJR24CX254*	RJR24FP254*	RJR24FW254*	RJR24FX254			
500K	RJR24CP504*	RJR24CW504*	RJR24CX504*	RJR24FP504*	RJR24FW504*	RJR24FX504			
1 MEG	RJR24CP105*	RJR24CW105*	RJR24CX105*	RJR24FP105*	RJR24FW105*	RJR24FX105			

RJ/RJR26 (Commercial Model 3262)

STD.		RJ26C			RJ26F		RJR26F				
OHMS	Р	W	x	Р	W	X	Р	W	X		
10	RJ26CP100	RJ26CW100	RJ26CX100	RJ26FP100	RJ26FW100	RJ26FX100	RJR26FP100*	RJR26FW100*	RJR26FX100*		
20	RJ26CP200	RJ26CW200	RJ26CX200	RJ26FP200	RJ26FW200	RJ26FX200	RJR26FP200*	RJR26FW200*	RJR26FX200		
50	RJ26CP500	RJ26CW500	RJ26CX500	RJ26FP500	RJ26FW500	RJ26FX500	RJR26FP500*	RJR26FW500*	RJR26FX500°		
100	RJ26CP101	RJ26CW101	RJ26CX101	RJ26FP101	RJ26FW101	RJ26FX101	RJR26FP101*	RJR26FW101*	RJR26FX101*		
200	RJ26CP201	RJ26CW201	RJ26CX201	RJ26FP201	RJ26FW201	RJ26FX201	RJR26FP201*	RJR26FW201*	RJR26FX201*		
500	RJ26CP501	RJ26CW501	RJ26CX501	RJ26FP501	RJ26FW501	RJ26FX501	RJR26FP501*	RJR26FW501*	RJR26FX501*		
1K	RJ26CP102	RJ26CW102	RJ26CX102	RJ26FP102	RJ26FW102	RJ26FX102	RJR26FP102*	RJR26FW102*	RJR26FX102*		
2K	RJ26CP202	RJ26CW202	RJ26CX202	RJ26FP202	RJ26FW202	RJ26FX202	RJR26FP202*	RJR26FW202*	RJR26FX202*		
5K	RJ26CP502	RJ26CW502	RJ26CX502	RJ26FP502	RJ26FW502	RJ26FX502	RJR26FP502*	RJR26FW502*	RJR26FX502		
10K	RJ26CP103	RJ26CW103	RJ26CX103	RJ26FP103	RJ26FW103	RJ26FX103	RJR26FP103*	RJR26FW103*	RJR26FX103*		
20K	RJ26CP203	RJ26CW203	RJ26CX203	RJ26FP203	RJ26FW203	RJ26FX203	RJR26FP203*	RJR26FW203*	RJR26FX203*		
25K	RJ26CP253	RJ26CW253	RJ26CX253	RJ26FP253	RJ26FW253	RJ26FX253	RJR26FP253*	RJR26FW253*	RJR26FX253		
50K	RJ26CP503	RJ26CW503	RJ26CX503	RJ26FP503	RJ26FW503	RJ26FX503	RJR26FP503*	RJR26FW503*	RJR26FX503		
100K	RJ26CP104	RJ26CW104	RJ26CX104	RJ26FP104	RJ26FW104	RJ26FX104	RJR26FP104*	RJR26FW104*	RJR26FX104		
250K	RJ26CP254	RJ26CW254	RJ26CX254	RJ26FP254	RJ26FW254	RJ26FX254	RJR26FP254*	RJR26FW254*	RJR26FX254		
500K	RJ26CP504	RJ26CW504	RJ26CX504	RJ26FP504	RJ26FW504	RJ26FX504	RJR26FP504*	RJR26FW504*	RJR26FX504		
1 MEG	RJ26CP105	RJ26CW105	RJ26CX105	RJ26FP105	RJ26FW105	RJ26FX105	RJR26FP105*	RJR26FW105*	RJR26FX105		

RJ/RJR50 (Commercial Model 3329)

STD.	RJ50C	RJ50F	RJR50F
VALUES OHMS	Р	Р	Р
10	RJ50CP100	RJ50FP100	RJR50FP100
20	RJ50CP200	RJ50FP200	RJR50FP200
50	RJ50CP500	RJ50FP500	RJR50FP500
100	RJ50CP101	RJ50FP101	RJR50FP101
200	RJ50CP201	RJ50FP201	RJR50FP201
500	RJ50CP501	RJ50FP501	RJR50FP501
1K	RJ50CP102	RJ50FP102	RJR50FP102
2K	RJ50CP202	RJ50FP202	RJR50FP202
5K	RJ50CP502	RJ50FP502	RJR50FP502
10K	RJ50CP103	RJ50FP103	RJR50FP103
20K	RJ50CP203	RJ50FP203	RJR50FP203
25K	RJ50CP253	RJ50FP253	RJR50FP253
50K	RJ50CP503	RJ50FP503	RJR50FP503
100K	RJ50CP104	RJ50FP104	RJR50FP104
250K	RJ50CP254	RJ50FP254	RJR50FP254
500K	RJ50CP504	RJ50FP504	RJR50FP504
1 MEG	RJ50CP105	RJ50FP105	RJR50FP105

^{*}Last letter in number is failure rate level. M=1.0% P=0.1% R = 0.01% For replacement purpose only. Not for new design.



TRIMMER LAB DESIGN KIT

- Wide assortment of popular trimmers
- Convenient, easy-to-use packaging
- Single-turn and multiturn styles
- Many configurations in both cermet and wirewound element types

Model H-800

TrimBin™ Trimmer Kit

A complete assortment of the most popular through-hole trimmer styles from Bourns Trimpot is contained in one convenient package. The kit contains 126 parts representing 50 varieties of resistances and pin styles.

Select the size, shape, type of element, and method of adjustment to suit your application.



SURFACE MOUNT LAB DESIGN KIT

- Full line of surface mount products
- Convenient, easy-to-use packaging
- Single-turn, multiturn, sealed, open-frame styles
- Popular styles and ohmic values

Model H-814

Surface Mount Kit

A complete assortment of the most popular surface mount products from Bourns Trimpot is contained in this convenient lab design kit. It contains 220 parts in popular styles and resistance values to help in your design selection.

Also included are complete performance parameters and specifications for each model in the kit. Plus, a convenient Adjustment Tool.

SOLDERING AND CLEANING PROCESSES

This application note is designed to provide step-by-step processing recommendations. It covers the popular SMC soldering processes currently in use and provides recommendations and cautions for each step. Since many variations of temperature, time, processes, cleaning agents and board types are found in the electronics industry, you'll want to test and verify your own system.

The process steps, recommendations and cautions are based on Bourns Trimpot surveys of SMC users, equipment manufacturers and materials suppliers. Also, comments reflect results of Bourns' testing. Our findings suggest the following soldering and cleaning processes:

- 1. SOLDERING Forced Hot Air, Convection, IR, Vapor Phase (In-Line), Wave (Single and Dual)
- 2. CLEANING Solvent, Aqueous, Semi-Aqueous, No-Clean

Solder Paste Printing

Reflow

GENERAL Use the optimum solder paste for the pattern, printing process, solder paste density and solder joint quality.

RECOMMENDED Use Sn 63% Pb 37% solder paste. Use 8 to 10 mil thickness for solder paste print.

CAUTION Since solder paste usually contains a high percentage of activators, you must ensure adequate cleaning to remove all residues, unless no-clean (low solids) paste is used.



Adhesive Application

Flow (Wave)

GENERAL The adhesive must hold the SM Component (SMC) in correct orientation upon placement and maintain correct trimmer position during physical handling before final solder processing.

RECOMMENDED To assure positional stability, place a single dot of epoxy under the



CAUTION Stability after placement is a direct function of the volume of adhesive used. Use enough epoxy to assure stability through the cure process.

Avoid overflow of epoxy to solder pad and terminal areas.

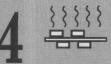
Placement

GENERAL Use pick-and-place equipment with vacuum nozzle ID size that allows adequate suction to pick the SMC out of the embossed cavity.

RECOMMENDED The nozzle inside diameter (ID) should not exceed .100 in. (2.54mm) to ensure adequate suction and part alignment.

CAUTION Assure parts are placed so that all terminals are equidistant (<4 mils) from the solder pads.

Align terminals with solder belt direction of travel to avoid body shadowing effects during flow soldering.



Adhesive Cure

Flow (Wave)

GENERAL Use heat/time cure method with either convection oven or infrared radiation.

RECOMMENDED Cure using the temperature and times recommended by the adhesive manufacturer.

CAUTION Use enough cure time to assure complete adhesive transition from fluid to solid.



Application

Flow (Wave)

GENERAL Use the correct flux to remove surface oxides, prevent reoxidation and promote wetting.

RECOMMENDED

- RMA No-clean SRB (Synthetic resin based)
- OA (Organic Acid) (See caution)

CAUTION Avoid highly activated fluxes. Consult factory before using OA.

These are the common methods, materials and maximum temperature/time parameters for soldering and cleaning processes:

				SOLD	ERING/CL	EANING I	WETHODS						
REFLOW								FLOW				BELLOT WON	
Hot Air; Infrared (Solvent)	Hot Air; Infrared (Semi-Aq)	Hot Air; Infrared (Aqueous)	Hot Air; Infrared (No-Clean)	Vapor Phase (Solvent)	Vapor Phase (Semi-Aq)	Vapor Phase (Aqueous)	Vapor Phase (No-Clean)	Wave (Solvent)	Wave (Semi-Aq)	Wave (Aqueous)	Wave (No-Clean)	Material Material	
X	X	X	X	X	X	Χ.	X	achievi	OS ETUC	NA! DIE	od gnig	ments bine premimica	
		.lenion	DOM: MISC	od bel	GILLEGIS	I WW	retention	X	X	X	X	of three equipments	
X	X	X	X	X	X	X	X	X	X	X	X	bava also included.	
SGAWCSC)	recipid	trinicalt	ano and	a vacuus	at wars!		NE M	X	X	X	X	es a res mesniona	
faces o	incie to la	d annie	talson v	and all	asian	l morti	A form	X	Kerff te	elt arienia	St. Auror A	Rosin	
. American	Les Arrest		da water	and all	· Salarana			& John	X	Nichta B	- Admin	Rosin	
	7	CONTRACT OF	THE CHARGE		10711767			T. Verrie		X		Organic Acid	
COLLINA	AGANTI S	am Ot o	Section 1	CIU III	DOME		I INTERNET	to Sim	COUNTY OF	ING BUI	X	Synthetic Resin Based	
X	X	0.0118	X	X	X	X	X	OUR HOS	3 21 22 12	MIN IEN	G ASHIPS	63/37 Sn/Pb	
28 80 8	JETTE	BD MB/IU	19719G	SHOW.	ST 10,1012	1001	g to se	Χ	X	X	6391.64	63/37 Sn/Pb	
X	AW IS 0	DIVOTO	enormone	X	00		- AVOID	X	085 V 88	SOVOVO	of sten	ODS Free	
mumba	X	s, versu	mone	10 01	X	210	minter.	cinters	X	d doze	II H WO	Terpene, Hydrocarbon Based	
od naa	tuatuo	X	dt .08/4	(bnuo	wenity	X	enbelv	orpi ene	in ad i	X	Hive to	DI H20; Surfacant; Saponifier	
our too	mola su	X	th models	action h	anleah	X				Χ	net onk	(See Caution)	
240/30	240/30	240/30	240/30	215/180	215/180	215/180	215/180	260/5	260/5	260/5			
	Infrared (Solvent) X X X X	Infrared (Solvent)	Infrared (Solvent)	Hot Air, Infrared (Solvent) Hot Air, Infrared (Solvent) X	Hot Air;	Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent) Hot Air, Infrared (Aqueous) (No-Clean) (Solivent) K	Hot Air, Infrared (Solivent) Hot Air, Infrared (Aqueous) Hot Air, Infrared (No-Clean) Hot Air, Infrared (Solivent) Hot Air, Infrared (No-Clean) Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent) Hot Air, Infrared (No-Clean) Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent) Hot Air, Infrared (No-Clean) Hot Air, Infrared (Solivent) Hot Air, Infrared (No-Clean) Hot Air, Infrared (No-Clean)	Hot Air, Infrared (Solivent) Hot Air, Infrared (Aqueous) Hot Air, Infrared (No-Clean) Hot Air, Infrared (Solivent) Hot Air, Infrared (Solivent)	Hot Air; Infrared (Solivent) Hot Air; Infrared (No-Clean) Hot Air; Infrared (No-Clean)	REFLOW	Hot Air; Infrared (Solivent) Hot Air; Infrared (Solivent)	Hot Air; Infrared (Solivent) Hot Air; Infrared (Solivent)	

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Solder Reflow; Hot Air, IR and Vapor

Min. Temp. (°C)

Phase

GENERAL Preheat sufficiently using both time and temperature to vaporize all solder paste solvents and moisture, leaving only solder and flux as component enters solder reflow phase.

RECOMMENDED Solder zone profile of 230°C for 20 seconds.

CAUTION

Do not exceed time and temperature reflow profile of 240°C for 30 seconds for hot air/IR reflow and 215°C for 3 minutes for vapor phase reflow. Use 215°C as minimum reflow temperature.

Minimize thermal shock by limiting temperature rise rate to 3°C/sec and by stabilizing board and components temperature during preheating.

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Solder Flow (Wave)

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GENERAL

For maximum component reliability and performance, minimize the time of temperature exposure above 200°C.

RECOMMENDED Use SN 63% Pb 37% solder. Solder zone profile of 245°C for 5 seconds.

CAUTION

Do not exceed 260°C peak temperature for dual wave solder process with a flow zone totaling 5 seconds.

Minimize thermal shock by limiting temperature rise rate to 3°C/sec and by stabilizing board and components temperature during preheating.

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Wash Solvent

GENERAL

Use solvent cleaning primarily for nonpolar contaminants such as rosin based flux residues.

RECOMMENDED

Use any suitable washing solvents that meet ODC requirements.

CAUTION

Limit excessive direct spray pressure to 60 psi or below for optimum reliability.

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215

Wash Semi-Aqueous

GENERAL

Use semi-aqueous for nonpolar contaminants such as rosin based flux residues.

RECOMMENDED

Use terpene or hydrocarbon based for prewash. Use water for final wash.

CAUTION

Limit excessive direct spray pressure to 60 psi or below for opti-mum reliability.

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Wash

Aqueous

GENERAL

Use aqueous cleaning primarily for polar contaminants such as organic flux residues.

RECOMMENDED

Use any of these aqueous wash materials:

- · Deionized water
- Surfactants
- · Saponifiers

CAUTION

Limit excessive direct spray pressure to 60 psi or below for optimum reliability. Ultrasonics may cause component damage or failure

GENERAL

No-Wash

No-wash is an option when no-clean (low solids) flux is used for solder operations.

Board Rework Technique



GENERAL

Excessive and/or repeated high temperature heat exposure may affect component performance and reliability.

RECOMMENDED Hot air reflow technique is preferred.

CAUTION

Avoid use of a soldering iron or wave soldering as a rework technique



APPLICATIONS/PROCESSING GUIDE and about the second and the second

HOW TO USE THIS SECTION

This Applications/Processing Guide is intended to provide you with points to consider for designing circuits, selecting trimmers and arranging board layouts, to achieve maximum performance and long life for your circuits and systems. We have also included information on steps your manufacturing engineers can take to preserve circuit reliability.

For example, are you aware that the trimmers and other mechanical components on your boards may face a more extreme environment during boardwashing on your own production line, than they ever will in use? For those trimmers that may need to be reset, are you remembering to select and mount the trimmers to provide easy accessibility?

In this section, you'll find dozens of pointers, reminders and useful facts that will help you be more knowledgeable and successful in using trimmers.

TRIMMER BASICS

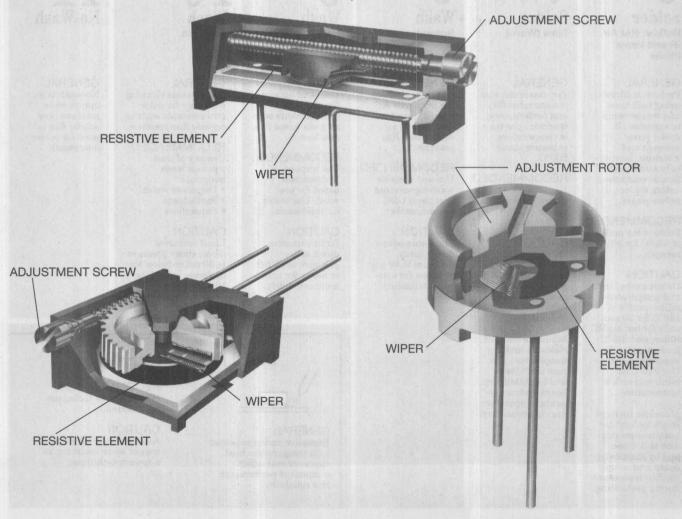
In its most common form, a trimmer is simply a device containing a resistive element, and a wiper, or adjustable tap, contacting the element. The wiper can be mechanically moved to vary the amount of voltage or resistance in the circuit. The resistive element is usually laid out in linear or a circular configuration:

The Resistive Element

Trimmers for commercial applications typically have a resistive element made of carbon or cermet (a combination of CERamic and METal), or of resistance wire wound on an insulated copper mandrel.

The main advantages of wirewound trimmers are their low temperature coefficient, higher power dissipation, lower noise, tighter resistance tolerance, and, when used as a variable resistor, the excellent current-carrying capacity through the wiper due to the lower contact resistance. Also, their long-term resistance stability with time and temperature is slightly better than cermet.

Cermet trimmers provide a wider resistance range (10 ohms to 5 megohms, versus a maximum of 50K ohms for wirewound). Also, the wiper output can be set closer to the desired value since the resistive element presents a continuous contact surface for the wiper, as opposed to the discrete turns (resolution) of the wirewound. Other advantages with cermet are the lower reactance in high-frequency applications, the smaller sizes available, and the generally lower price than wirewound types.



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TRIMMING POTENTIOMETERS AND DEFINITIONS

The following terms and definitions have been edited from the Industrial Standard published by the Variable Resistive Components Institute. It is intended to encourage standardization in communication and understanding between the manufacturer and user. The complete standard, including detailed test procedures, is available upon request.

GENERAL TERMS

TRIMMING POTENTIOMETER: An electrical mechanical device with three terminals. Two terminals are connected to the ends of a resistive element and one terminal is connected to a movable conductive contact which slides over the element, thus allowing the input voltage to be divided as a function of the mechanical input. It can function as either a voltage divider or rheostat.

WIREWOUND TRIMMING POTENTIOMETER: A trimming potentiometer characterized by a resistance element made up of turns of wire on which the wiper

contacts only a small portion of each turn.

NON-WIREWOUND TRIMMING POTENTIOMETER: A trimming potentiometer characterized by the continuous nature of the surface area of the resistance element to be contacted. Contact is maintained over a continuous, unbroken path. The resistance is achieved by using material compositions other than wire such as carbon, conductive plastics, metal film and cermet.

RESISTANCE ELEMENT: A continuous, unbroken length of resistive material without joints, bonds or welds except at the junction of the element and the electrical terminals connected to each end of the element, or at an intermediate

point such as a center tap.

ADJUSTMENT SHAFT: The mechanical input member of a trimming potentiometer which when actuated causes the wiper to traverse the resistance element resulting in a change in output voltage or resistance.

SINGLE TURN ADJUSTMENT: Requires 360° or less mechanical input to cause the wiper to traverse the total

resistance element.

MULTITURN ADJUSTMENT: Requires more than 360° mechanical adjustment to cause the wiper to traverse the total resistance element.

TERMINAL: An external member that provides electrical access to the resistance element and wiper.

LEADWIRE TYPE TERMINAL: Flexible insulated conductor.

PRINTED CIRCUIT TERMINAL: Rigid uninsulated electrical conductor, suitable for printed circuit board plug-in

SOLDER LUG TERMINAL: Rigid uninsulated electrical conductor, suitable for external lead attachment.

WIPER: The wiper is the member in contact with the resistive element that allows the output to be varied when the adjustment shaft is rotated.

STOP-CLUTCH: A device which allows the wiper to idle at the ends of the resistive element without damage as the adjustment shaft continues to be actuated in the same direction. STOP - SOLID: A positive limit to mechanical and/or electrical adjustment.

STACKING: The mounting of one trimming potentiometer adjacent to or on top of another utilizing the same

mounting hardware.

THEORETICAL RESOLUTION: (Wirewound only) The theoretical measurement of sensitivity to which the output ratio may be adjusted; the reciprocal of the number of turns of wire in resistance winding expressed as a percentage.

N = Total number of resistance wire turns.

V = Total Harrisor of Toolstands with tarris

 \overline{N} X 100 = Theoretical resolution percent.

INPUT AND OUTPUT TERMS

TOTAL APPLIED VOLTAGE: The total voltage applied between the designated input terminals.

OUTPUT VOLTAGE: The voltage between the wiper terminal and the designated reference point. Unless otherwise specified, the designated reference point is the CCW terminal.

OUTPUT RATIO: The ratio of the output voltage to the designated input reference voltage. Unless otherwise specified, the reference voltage is the total applied voltage.

LOAD RESISTANCE: An external resistance as seen by the Output Voltage (Connected between the wiper terminal and the designated reference point.)

ADJUSTMENT TERMS

DIRECTION OF TRAVEL: Clockwise (CW) or counterclockwise (CCW) rotation when viewing the adjustment end of the potentiometer.

MECHANICAL TRAVEL — SOLID STOPS: The total travel of the adjustment shaft between integral stops. Continuity must be maintained throughout the travel.

MECHANICAL TRAVEL — CLUTCHING ACTION: The total travel of the adjustment shaft between the points where clutch actuation begins. Continuity must be maintained throughout the travel and during clutch actuation.

MECHANICAL TRAVEL — CONTINUOUS ROTATION: The total travel of the adjustment shaft when the wiper movement is unrestricted at either end of the resistive element as the adjustment shaft continues to be actuated.

ADJUSTMENT TRAVEL (ELECTRICAL): The total travel of the adjustment shaft between minimum and maximum output voltages.

CONTINUITY TRAVEL: The total travel of the shaft over which electrical continuity is maintained between the wiper and the resistance element.

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ELECTRICAL AND OPERATIONAL CHARACTERISTICS

TOTAL RESISTANCE: The DC resistance between the input terminals with the wiper positioned to either end stop, or in dead band for continuous rotation potentiometers.

TEST VOLTAGE

Total Resistance, Nominal	Maximum Test Voltage				
	Non-Wirewound	Wirewound			
Ohms	Volts DC	Volts DC			
.1 TO 1.0	0.1	0.1			
1.0 to 50	0.3	0.3			
50 to 100	2.0	2.0			
100 to 1000	3.0	3.0			
1K to 100K	net tuon 10 langles	0 0 10			
Over 0.1 megohm	ov and 50 ALICY	TUPTHO			

NOTE: The test voltages should never exceed the equivalent of 10% rated power. The minimum voltage to be used is 10 MV.

ABSOLUTE MINIMUM RESISTANCE: The resistance measured between the wiper terminal and each end terminal with the wiper positioned to give a minimum value.

END RESISTANCE: The resistance measured between the wiper terminal and an end terminal when the wiper is positioned at the corresponding end of mechanical travel. Absolute minimum resistance and end resistance are synonymous for continuous rotation trimmers.

TEMPERATURE COEFFICIENT OF RESISTANCE: The unit change in resistance per degree Celsius change from a reference temperature, expressed in parts per million per degree Celsius as follows:

$$TC = \frac{R^2 - R^1}{R^1 (T^2 - T^1)} \times 10^6$$

Where:

 R^1 = Resistance at reference temperature in ohms.

 R^2 = Resistance at test temperature in ohms.

 T^1 = Reference temperature in degrees Celsius.

T² = Test temperature in degrees Celsius.

RESISTANCE-TEMPERATURE CHARACTERISTIC: The difference between the total resistance values measured at a reference temperature of 25°C and the specified test temperature expressed as a percent of the Total Resistance.

$$RTC = \frac{R^2 - R^1}{R^1} \times 100$$

Where:

R¹ = Resistance at reference temperature (25°C) in ohms.

 R^2 = Resistance at the test temperature in ohms.

CONTACT RESISTANCE VARIATION: The apparent resistance seen between the wiper and the resistance element when the wiper is energized with a specified current and moved over the adjustment travel in either direction at a constant speed. The output variations are measured over a specified frequency bandwidth, exclusive of the effects due to roll-on or roll-off of the terminations and is expressed in ohms or % of total resistance.

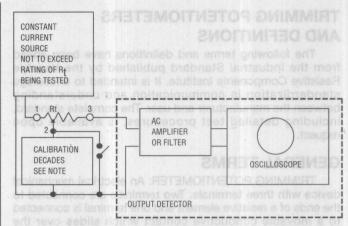


Figure 1. Contact-resistance-variation measuring circuit

Rt = Test specimen

Output detector bandwidth: 100 cycles to 50 kilocycles Minimum input impedance to output detector:

At least 10 times the nominal resistance being tested

NOTE: At the calibration of the decade, terminals 1 and 2 must be coincident.

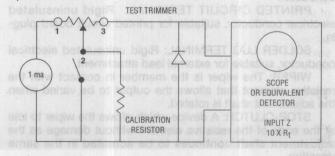
Calibration decade is to be set for the contact-resistance variation

(CRV) level of the specified nominal resistance being tested.

TABLE II

Test Current (±20%)	Total Resistance Range				
30 ma	2 = Rt = 200				
5 ma	200 < Rt = 3K				
animat i 1 ma	3K < Rt = 200K				
200 ua	200K Rt = 1 megohm				
50 ua	1 megohm · Rt = 5 megohm				

EQUIVALENT NOISE RESISTANCE: Wirewound only. Any spurious variation in the electrical output not present in the input, defined quantitatively in terms of an equivalent parasitic, transient resistance in ohms, appearing between the contact and the resistant element when the shaft is rotated. The equivalent Noise Resistance is defined independently of the resolution, functional characteristics and the total travel. The magnitude of the Equivalent Noise Resistance is the maximum departure from a specific reference line. The wiper of the potentiometer is required to be excited by a specific current and moved at a specific speed.



CONTINUITY: Continuity is the maintenance of continuous electrical contact between the wiper and both end terminals of the resistive element.

SETTING STABILITY: The amount of change in the output voltage, without readjustment, expressed as a

percentage of the total applied voltage.

DIELECTRIC STRENGTH: The ability to withstand the application of a specified potential of a given characteristic, between the terminals and all other external conducting members such as shaft, housing and mounting hardware without exceeding a specified leakage current value.

INSULATION RESISTANCE: The resistance to a specified DC voltage impressed between the terminals and all other external conducting members such as shaft,

housing and mounting hardware.

POWER RATING: The maximum power that a trimming potentiometer can dissipate across the total resistive element under specified conditions while meeting specified

performance requirements.

ROTATIONAL LIFE: The number of cycles obtainable under specified operating conditions while remaining within specified allowable degradation. A cycle is defined as one complete traversal of the wiper over the resistive element in both directions.

LOAD LIFE: The number of hours at which a device may dissipate rated power under specified operating conditions while remaining within specified allowable degradations.

ADJUSTABILITY (OUTPUT RESISTANCE): The precision with which the output resistance of a device can be set to the desired value.

ADJUSTABILITY (OUTPUT VOLTAGE RATIO): The precision with which the output voltage ratio of a device can be set to the desired value.

MECHANICAL TERMS

STARTING TORQUE: The maximum moment in the clockwise and counterclockwise directions required to initiate shaft adjustment anywhere in the mechanical travel.

STOP TORQUE: The maximum static moment that can be applied to adjustment shaft at each mechanical stop for a specified period of time without loss of continuity or mechanical damage affecting operational characteristics.

SOLDERABILITY: The ability of the terminals to accept a uniform coating of solder under specified conditions.

WELDABILITY: The ability of materials to be welded

together under specified conditions.

TERMINAL STRENGTH: The ability of the terminals to withstand specified mechanical stresses without sustaining damage that would affect utility of the terminals or operation of the trimming potentiometer.

IMMERSION SEALED: The ability of the unit to withstand submersion in acceptable cleaning solutions used in normal soldering processes without performance degradation under

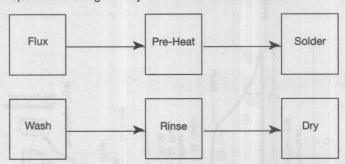
specified environmental conditions.

TRIMMER "-ABILITIES"

When you are selecting components for a new design, you typically take into account the environmental conditions that the components will need to endure during the lifetime of the instrument or device. Designers in the past have often overlooked the environmental extremes of their own production lines, where the conditions may be much more severe than anything encountered in actual end use.

PROCESSABILITY

"Processability" refers to the ability of the unit to withstand the production-line processes associated with the finishing steps on the PC boards. Typically, both SMT and through-hole products are subjected to similar PC board processing operations after preparation for assembly. These operations can generally be summarized as follows:



Soldering (SMT)

Four types of equipment are usually associated with SMT soldering:

IR System — Uses a multi-zone infrared furnace with IR elements heated to a temperature substantially above chamber or product temperature. Energy is supplied to the product primarily by IR radiation to reflow solder.

Forced Hot Air Convection System — Uses a multizone forced air convection system with heat source panels using IR or other type heating elements. Approximately 85% of the heating is provided by free convection to reflow solder on exposed PC boards.

Dual Wave System - Utilizes two parallel solder waves. The first is a turbulent wave followed by a laminar wave. The turbulent wave is for small, constricted areas, while the laminar wave removes solder projections.

Vapor Phase System - Provides a single-zone condensation heat source achieved with liquid fluorinated hydrocarbons that have been brought to the boiling point to create a saturated vapor zone. Heat is then released by the fluid's heat of vaporization as the vapor condenses on the product.

Soldering (Through-hole)

Two types of equipment are usually associated with through-hole soldering:

Single Wave System — Provides an inclined portion of the solder wave for the PC board to pass over. The PC board is positioned to bring many potential solder joints in contact with the wave simultaneously for a short time for soldering.

Drag System — Provides for PC boards to be dragged across the surface of the solder pot. Soldered connections are made during this operation.

PC Board Washing

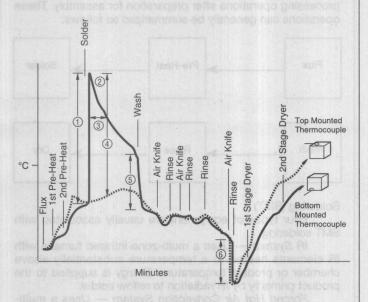
Two types of equipment are usually associated with both SMT and through-hole products.

Pressure System - Accomplishes cleaning by directing sprays of water under high pressure from multiple nozzles.

Flooding System — Utilizes a combination of flooding (at normal water pressure) and surfactant action for cleaning).

Soldering and Wash Processes

Figure 1 shows typical profiles any component may see during a soldering and board washing operation. For details of material and process variables recommendations, see "Soldering and Cleaning Processes", page 74.



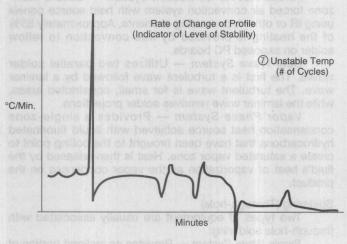


Figure 1.
Typical temperature profile for board washing and soldering.

Critical profile parameters

- 1 Temperature Shock (°C)
- ② Maximum Temperature (°C)
- 3 Temperature Exposure (Minimum)
- (4) Temperature Gradient (°C)
- (5) Temperature Shock Decrease in Water (°C)
- 6 Temperature Shock Decrease in Water & Air Pressure (°C)
- 7 Unstable Temperature (see next page)

General Guidelines for Guarding Against Component Damage

To minimize temperature shock

- Pre-heat boards to maximum acceptable level
- Reduce time in solder

To avoid heating components above their maximum rated temperature

- Use lowest acceptable solder temperature
- Use maximum allowable conveyor speed
- Limit pre-heat temperature to maximum necessary

To limit time of exposure above rated temperature

- · Limit time in solder
- After solder operation, cool board to wash temperature before it enters wash

To minimize temperature difference between top and bottom of board

Apply pre-heat to both top and bottom

To reduce temperature shock on entering the moist environment of the wash

- Use wash/rinse temperature as near component temperature as possible
- Extend time between solder process and wash
- Cool board after solder operation, prior to entering wash

To minimize temperature variations as component travels through moisture

- Minimize number of wash/rinse and rinse/dry cycles
- Use heated air for air knives (to counter evaporative cooling effect)
- Minimize difference between wash and rinse temperature

To minimize exposure to high-pressure water during board wash

 Select trimmer models with pin styles that orient the rotor seal area away from exposure to the high-pressure water stream

SETTABILITY

Settability refers to the ease with which a trimmer can be set accurately to the position that produces the desired circuit condition.

Where the requirement is for obtaining a highly accurate setting the preference is for cermet — because a small incremental adjustment in a wirewound unit does not always produce the expected change in output as the wiper moves off one turn of wire and onto another.

Setting accuracy is better with a multiturn unit than with a single-turn. This is especially true when the speed of setting is also a requirement as on a production line (Figure 2).

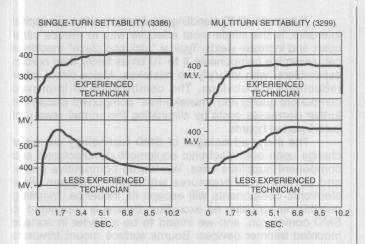


Figure 2.

When accurate setting is required, a multiturn trimmer can generally be set faster than a single-turn.

STABILITY

Stability refers to the ability of the trimmer to remain at the desired setting. Environmental factors play an important role here: stability may be affected by temperature exposure, thermal shock/cycling, humidity, and mechanical shock or vibration.

This is not a matter of concern in most applications, since Bourns trimmers exhibit excellent stability under all specified conditions. Stability is most often a concern when cermet trimmers are used in low current "dry" circuits (50uA amps and below). Under these conditions the contact resistance may vary, making the wiper appear unstable. This is most noticeable in some rheostat applications. This can be avoided by using a wirewound unit, or choosing a cermet trimmer that has been designed for dry-circuit applications. Bourns applications engineers can assist you on this and other questions.

ACCESSIBILITY

When selecting a trimmer and determining its placement on the board, keep in mind the people who will have to use it. Bourns trimmers are available in a wide variety of sizes, shapes, configurations, and placement of adjustment screws. You will usually find a unit on which the access for adjustment will be convenient for the user.

Keep in mind the different requirements for accessibility depending on whether adjustment will be done on the assembly line or in the field; with the board uncovered, in a housing or cabinet, or on an extender. Also consider whether production-line adjustment will be done manually or by robotics. A Bourns applications engineer can advise on special high-speed automatic adjustment features.

USABILITY

In selecting a trimmer for a specific application, it's important to be aware that the catalog contains a myriad of facts about each model that can assist you in finding the most suitable choice. For example:

Contact Resistance Variation (CRV) — Under MIL-R 22097 and MIL-R-39035, the maximum CRV is 3%. All Bourns

trimmers meet this standard (3% or 3 ohms, whichever is greater). For applications that demand a more rigorous standard, some Bourns trimmers are rated at 2% or 2 ohms, and many others at 1% or 1 ohm.

Power Rating — The ambient temperature at which the trimmer will operate has an important bearing on power rating. Power ratings are usually specified at 70° or 85°C; at a temperature of 150°C, the power rating of many trimmers is reduced to zero.

Temperature Coefficient of Resistance (T.C.) — This specification is a measure of how much the resistance changes with a change in temperature. In many applications a T.C. of ±250PPM/°C is acceptable. Typical T.C. specifications for cermet models are ±100PPM/°C and ±50PPM/°C for wirewound models.

RELIABILITY

One of the greatest challenges facing American manufacturers in the early '90s lies in the area of reliability — a challenge for component manufacturers and equipment manufacturers alike. Bourns has been on the leading edge of this effort, both in the area of instituting new methods and technologies for achieving higher reliability, and bringing an awareness of the need to other manufacturers.

SURFACE MOUNTED DEVICES (SMD) — AN EMERGING TECHNOLOGY

Surface mounting of electronic components represents another significant advance in PC board processing. Many U.S. companies have expressed an interest in SMD assembly methods to replace the often troublesome and costly techniques now used with leaded components. Unfortunately, for a number of reasons, this interest has not resulted to date in a major commitment to SMD handling equipment.

There are direct and indirect benefits associated with surface mounting. Since the direct benefits are outgrowths of the indirect ones, some explanation of these interrelated factors is required in order to understand this complex, highly technical and investment intensive subject. Further, a listing of the primary advantages will make additional comments on Japan's SMD usage and growth unnecessary.

In capsule format, the primary advantages (with comments on secondary benefits) are:

- Lower End-Equipment Cost (positions OEM's for aggressive pricing to achieve market penetration).
- Superior Product Performance (satisfies user requirements for improved operational performance).
- Improved Product Quality and Reliability (creates confidence factor which easily translates to increased demand or sales).
- Smaller Finished Product Size (addresses demand for miniaturization).

Cost, performance, quality/reliability and size — how are these factors interrelated and how are they achieved through surface mounting?



A by-product of SMD technology is the downsizing of components. Size reductions range from 25% to 60%, depending upon the device in question. High PC board densities can be achieved (more components per square inch of real estate; surface mounted units can also be assembled on both sides). PC board material savings alone are substantial. When circuits diminish, external hardware and other materials follow - further savings. Even freight charges are decreased by lighter equipment weight and less packaging.

Surface mounted component prices are forecasted to decline, the result of automated volume production. Volume is directly related to component standardization. By having a few sizes to cover a large range of electrical values and/or parameters, large quantities of a given device can be produced at a much lower per unit cost. Selling prices fall as volume increases. Component quality is also enhanced by eliminating many of the variables associated with short production runs.

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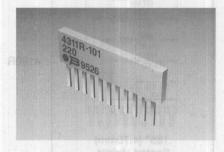
Automatic SMD handling equipment, although capital intensive, is the single-most effective way to reduce labor costs and increase yields. Typical "pick and place" machines can assemble components 8 to 10 times faster than human assemblers, with virtually no mistakes. Major direct labor reductions are obvious. The combination of improved component quality and "mistake-free" component placement further decreases costs by eliminating the normal rework of auto-inserted boards.

The many advantages of SMD technology will force change upon both electronic equipment manufacturers and component suppliers alike. Worldwide competitive prices and performance pressures will make it happen. Few electronic components will escape its influence, trimming potentiometers being no exception. Bourns is committed to SMD conversion, and we intend to be a leader in surface mounted trimmer devices. Bourns surface mount trimmers begin on page 9.



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Thin Film Applications153



For a complete listing of styles in stock and readily available through distribution, see page 90.



RESISTOR NETWORKS PRODUCT SELECTION GUIDE Thick Film, Molded DIPs

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Dual Terminators	Page No.
Molded DIP Low Profile		8	4108R-001-RC	4108R-002-RC	4108R-003-RC/RC	
1.065 MAX. (27.05) MAX. -965 (24.51) MAX.		14	4114R-001-RC	4114R-002-RC	4114R-003-RC/RC	
.865 (21.97) MAX. -765 (19.43) MAX.	4100R	16	4116R-001-RC	4116R-002-RC	4116R-003-RC/RC	92
.465 (11.81) MAX.		18	4118R-001-RC	4118R-002-RC	4118R-003-RC/RC	
.185" (4.70mm) Seated Height	For a chemi	20	4120R-001-RC	4120R-002-RC	4120R-003-RC/RC	

Thick Film, Molded SIPs

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Dual Terminators	Page No.
Molded SIP Low Profile		6	4306R-102-RC	4306R-101-RC	4306R-104-RC/RC	
1.084 MAX. ————————————————————————————————————		8	4308R-102-RC	4308R-101-RC	4308R-104-RC/RC	
	4300R	9		4309R-101-RC	4309R-104-RC/RC	94
(14.83) - MAX.		10	4310R-102-RC	4310R-101-RC	4310R-104-RC/RC	
.195" (4.96mm) Seated Height		11 08 r		4311R-101-RC	4311R-104-RC/RC	
Molded SIP Medium Profile		4	4304M-102-RC	4304M-101-RC	4304M-104-RC/RC	
784 (19.91) MAX. 584 (14.83) MAX. 384 (9.75) MAX.		6	4306M-102-RC	4306M-101-RC	4306M-104-RC/RC	
	4300M -	8	4308M-102-RC	4308M-101-RC	4308M-104-RC/RC	96
.250" (6.35mm) Seated Height		10	4310M-102-RC	4310M-101-RC	4310M-104-RC/RC	



RESISTOR NETWORKS PRODUCT SELECTION GUIDE Thick Film, Molded SIPs (continued)

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Dual Terminators	Page No.
Molded SIP High Profile	1-RC 480	4	4304H-102-RC	4304H-101-RC	4304H-104-RC/RC	
	1-RC 480	08M-10	M-102-RC 46	6 4600	(SCR) W. ARIOM	
.784 (19.91) MAX.	1-RC 460	6	4306H-102-RC	4306H-101-RC	4306H-104-RC/RC	
(14.83) MAX.	4300H	51 MB6	M-102-RC 46	ROBA 8	VIAN	98
384 (9.75) MAX.	1-RC 4601	8	4308H-102-RC	4308H-101-RC	4308H-104-RC/RC	(a) das.
	1-RC 461	DE-ME	3A		28 An 2014	
.350" (8.89mm) Seated Height	1-RC 461	10	4310H-102-RC	4310H-101-RC	4310H-104-RC/RC	

Thick Film, Conformal SIPs

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Dual Terminators	Page No.
	1-RC - 260	01 4/80	4604U-102-RC	4604U-101-RC	4604U-104-RC/RC	
Ultra-Low Profile	1-FIC 460	5	H-102-RC 46	4605U-101-RC	4605U-104-RC/RC	
MAXIMUM (3.81)	1-RC 480	6	4606U-102-RC	4606U-101-RC	4606U-104-RC/RC	
GARARA	1-90 460	7	94-102-RC 1 49	4607U-101-RC	4607U-104-RC/RC	
.150 (3.81mm) Seated Hei	ght 4600U	8	4608U-102-RC	4608U-101-RC	4608U-104-RC/RC	100
Pin A Maximum Inches (mm) 4 .398 (10.11)	1-RQ 461	9	0A-801-A	4609U-101-RC	4609U-104-RC/RC	5
5 .498 (12.65) 6 .598 (15.19) 7 .698 (17.73)	1-RC 461	10	4610U-102-RC	4610U-101-RC	4610U-104-RC/RC	
8 .798 (20.27) 9 .898 (22.81) 10 .998 (25.35)	1-RC 461	11		4611U-101-RC	4611U-104-RC/RC	
11 1.098 (27.89) 12 1.198 (30.43)	184 59-1	12	4612U-102-RC	4612U-101-RC	4612U-104-RC/RC	
Conformal SIP	1-110	4	4604X-102-RC	4604X-101-RC	4604X-104-RC/RC	
Low Profile	18C 481	5	na na ont su	4605X-101-RC	4605X-104-RC/RC	
A A (5.08)		6	4606X-102-RC	4606X-101-RC	4606X-104-RC/RC	
MAX.		7		4607X-101-RC	4607X-104-RC/RC	Argen
ALLALA .		8	4608X-102-RC	4608X-101-RC	4608X-104-RC/RC	
.200 (5.08mm) Seated Hei	ght	9		4609X-101-RC	4609X-104-RC/RC	
Pin A Maximum Inches (mm)	4600X	10	4610X-102-RC	4610X-101-RC	4610X-104-RC/RC	102
4 .398 (10.11) 5 .498 (12.65)		11		4611X-101-RC	4611X-104-RC/RC	OL, SM
6 .598 (15.19) 7 .698 (17.73) 8 .798 (20.27)	SHG DH-S	12	4612X-102-RC	4612X-101-RC	4612X-104-RC/RC	O dfiw
9 .898 (22.81) 10 .998 (25.35) 11 1.098 (27.89)		13		4613X-101-RC	4613X-104-RC/RC	13
12 1.198 (30.43)	944 DFI-9	14	4614X-102-RC	4614X-101-RC	4614X-104-RC/RC	
14 1.398 (35.51) 15 1.498 (38.05) 16 1.598 (40.59)		15	0A-900-40	4615X-101-RC	4615X-104-RC/RC	
Industrial Grade		16	4616X-102-RC	4616X-101-RC	4616X-104-RC/RC	



RESISTOR NETWORKS PRODUCT SELECTION GUIDE Thick Film, Conformal SIPs (continued)

		kage pe		Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Dual Terminators	Page No.
		rmal SIP		L Sau	4	4604M-102-RC	4604M-101-RC	4604M-104-RC/RC	
	Mediu	m Profile		3/17	5		4605M-101-RC	4605M-104-RC/RC	
	MAXIN	10.01	5)		6	4606M-102-RC	4606M-101-RC	4606M-104-RC/RC	
	DIT.	08 90		1-RC	017130	H-102-RG 43	4607M-101-RC	4607M-104-RC/RC	
	999				8	4608M-102-RC	4608M-101-RC	4608M-104-RC/RC	
.250	(6.35mm	n) Seated	Height		9		4609M-101-RC	4609M-104-RC/RC	
	Pin Count	A Maximu	ım m)	4600M	10	4610M-102-RC	4610M-101-RC	4610M-104-RC/RC	104
	4 5	.398 (10.1	11)		11		4611M-101-RC	4611M-104-RC/RC	4
	6 7 8	.598 (15.1 .698 (17.1 .798 (20.2	73)	08-1	12	4612M-102-RC	4612M-101-RC	4612M-104-RC/RC	
	9 10 11	.898 (22.8 .998 (25.3 1.098 (27.8	35)		13		4613M-101-RC	4613M-104-RC/RC	
	12 13 14	1.198 (30.4	13)		14	4614M-102-RC	4614M-101-RC	4615M-104-RC/RC	
	15 16	1.398 (35.5 1.498 (38.6 1.598 (40.5	05) 59)		15		4615M-101-RC	4616M-104-RC/RC	1
	Indust	rial Grade			16	4616M-102-RC	4616M-101-RC	4614M-104-RC/RC	
la la		rmal SIP	9-1	1 2 x	4	4604H-102-RC	4604H-101-RC	4604H-104-RC/RC	
	High	Profile .350		09-1	5	102-RC . 48	4605H-101-RC	4605H-104-RC/RC	
	MAXIM	(0.00)	4eosu	1-RG	6	4606H-102-RC	4606H-101-RC	4606H-104-RC/RC	
	OFF	OR NO		OFF-I	7.0	8U-102-RG 1 46	4607H-101-RC	4607H-104-RC/RC	
	im	M-+		09-1	8	4608H-102-RC	4608H-101-RC	4608H-104-RC/RC	
250	/0 00mm	n) Seated	Usiaht	08-1	9	ak nel one i ii	4609H-101-RC	4609H-104-RC/RC	2) 08r.
330	Pin	A Maximu		4600H	10	4610H-102-RC	4610H-101-RC	4610H-104-RC/RC	106
	Count 4	.398 (10.1	m)		11		4611H-101-RC	4611H-104-RC/RC	
	5 6 7	.498 (12.6 .598 (15.7 .698 (17.7	73)	OH-1	12	4612H-102-RC	4612H-101-RC	4612H-104-RC/RC	
	8 9 10	.798 (20.2 .898 (22.8 .998 (25.3	31) 35)	OR-I	13	OF THE STREET	4613H-101-RC	4613H-104-RC/RC	
	11 12 13	1.098 (27.8 1.198 (30.4 1.298 (32.9	39) 43)	1-RC	14	4614H-102-RC	4614H-101-RC	4614H-104-RC/RC	
	14 15 16	1.398 (35.5 1.498 (38.0 1.598 (40.5	51)	1-80	15	34 OH-S01-X0	4615H-101-RC	4615H-104-RC/RC	
	100	rial Grade	ACUUM.	1-RO	16	4616H-102-RC	4616H-101-RC	4616H-104-RC/RC	

Thick Film, Surface Mount Packages

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Dual Terminators	Page No.
SOL SMD 7.49mm Wide Body with Gull Wing Lead Form _295 ± .003 (7.493 ± .076)	4400P	16	4416P-001-RC 4416P-004-RC	4416P-002-RC	4416P-003-RC/RC	108
		20	4420P-001-RC 4420P-004-RC	4420P-002-RC	4420P-003-RC/RC	



RESISTOR NETWORKS PRODUCT SELECTION GUIDE Thick Film, Surface Mount Packages (continued)

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Dual Terminators	Page No.
SOM SMD 5.59mm Medium Body		14	4814P-001-RC	4814P-002-RC	4814P-003-RC/RC	
with Gull Wing Lead Form .220 ± .005 (5.59 ± .12)		16	4816P-001-RC 4816P-004-RC	4816P-002-RC	4816P-003-RC/RC	440
######################################	4800P	18	4818P-001-RC	4818P-002-RC	4818P-003-RC/RC	110
.300 ± .010 (7.62 ± .25)		20	4820P-001-RC 4820P-004-RC	4820P-002-RC	4820P-003-RC/RC	
SON SMD 3.9mm Narrow Body .236 ± .008		8	4908P-001-RC	4908P-002-RC	300 Pr-15-2	
(5.99 ± .20) TYP.	4900P	14	4914P-001-RC	4914P-002-RC	T.	112
.016 ± .003 (.406 ± .08) TYP.		16	4916P-001-RC	4916P-002-RC	Sistematics	

RC Networks Standard Circuits (Custom Circuits Available)

Package Type	Series Number	Pin Ct.	Capacitor Types	Capacitor Range	Circuit Type	Page No.
Molded DIP Low Profile				eqIO be	nin Film, Mole	
025 (635)	4100R-601	18,20	Z5U	50pf - 200pf	T-Filter	116
PIN #1 RÉF.		atha arra	XX XXXX-105-1	174 AT		
	XX XXXX S00	arra d	YOU XXXXX-100-1	18 ST		
SOGN SMD 7.49mm Wide Body, Gull Wing			28 XXXX-1957	20 4720		
.295 ± .003 (7.493 ± .076)				310 be		
• вывывыен 1 017 + 002	4400P-601	20	Z5U	50pf-200pf	T-Filter	116
.407 ± .010 (10.34 ± .25) .056) TYP.	XX XXXX-(01)	ASICET ASICET	xx xxxx hos-r	608A 8 //		



RESISTOR NETWORKS PRODUCT SELECTION GUIDE RC Networks Standard Circuits (Custom Circuits Available) (Continued)

Package Type	Series Number	Pin Ct.	Capacitor Types	Capacitor Range	Circuit Type	Page No.
Conformal SIP High Profile	OA-508-961		08-100-5014a 08-400-9814s	lat lat	will Week Lead Form.), ruleu
MAXIMUM 350 (8.89) MAX.	4600H-700	4-14	X7R, NPO	39pf-100Kpf	RC Terminator	118
ALLALA +	OR 500-905		4520R-001-RC	os l		
Conformal SIP Medium Profile					ON SMIL 3.9mm Namow Bedy	3
A .250 (6.35) MAX.	4600M-800	4-14	X7R	39pf-100Kpf	ECL Terminator	120
ADDADA :	0A-800-9-1		4914F-001-FIQ	1900P 14	I Tomas I	
Conformal SIP Medium Profile	SR-\$60-981		108-108-481EA	BI II	(B) (S(A))	
A .250 (6.35) MAX.	4600M-900	4-14	X7R	39pf-100Kpf	Isolated/Bussed	123
AAAAA †			24 25 25 25 25 25 25 25 25 25 25 25 25 25	The state of the s		

Thin Film, Molded DIPs

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Series Circuit	Page No.
Molded DIP		8	4108T-001-XXXX XX			
.180 + .005/011		14	4114T-001-XXXX XX	4114T-002-XXXX XX		
465 (11.81) MAX.	4100T	16	4116T-001-XXXX XX	4116T-002-XXXX XX		124
MAX.		18	4118T-001-XXXX XX	4118T-002-XXXX XX		
		20	4120T-001-XXXX XX	4120T-002-XXXX XX	ON Suid 7 Allmon	De l

Thin Film, Molded SIPs

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Series Circuit	Page No.
Molded SIP Low Profile (also available in medium		6	4306T-102-XXXX XX	4306T-101-XXXX XX	4306T-106-XXXX XX	
and high profile)		8	4308T-102-XXXX XX	4308T-101-XXXX XX	4308T-106-XXXX XX	
.584 .195 (14.83) (4.95) MAX. MAX.	4300T,S,K	9		4309T-101-XXXX XX	4309T-106-XXXX XX	126
WAX. WAX.		10	4310T-102-XXXX XX	4310T-101-XXXX XX	4310T-106-XXXX XX	
		11		4311T-101-XXXX XX	4311T-106-XXXX XX	



RESISTOR NETWORKS PRODUCT SELECTION GUIDE Thin Film, Conformal SIPs

Pack Typ	•	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Series Circuit	Page No.
	P Low Profile	THE STATE OF THE S	4	4604T-102-XXXX XX	4604T-101-XXXX XX	4604T-106-XXXX XX	-Flatte
(also available and high			5	-00-90sNa	4605T-101-XXXX XX	4605T-106-XXXX XX	
L ^_	.200		6	4606T-102-XXXX XX	4606T-101-XXXX XX	4606T-106-XXXX XX	
MAXIMU	JM (5.08) MAX.		7	-501-90944	4607T-101-XXXX XX	4607T-106-XXXX XX	
		T 168 993	8	4608T-102-XXXX XX	4608T-101-XXXX XX	4608T-106-XXXX XX	
1111	11-	623	9	186	4609T-101-XXXX XX	4609T-106-XXXX XX	
Pin Count	A Maximum Inches (mm)	4600T,S,K	10	4610T-102-XXXX XX	4610T-101-XXXX XX	4610T-106-XXXX XX	128
4 5	.398 (10.11) .498 (12.65)		11	SU SOUTH	4611T-101-XXXX XX	4611T-106-XXXX XX	
6 7	.598 (15.19) .698 (17.73)	100 000	12	4612T-102-XXXX XX	4612T-101-XXXX XX	4612T-106-XXXX XX	
8 9 10	.798 (20.27) .898 (22.81) .998 (25.35)	14-1988	13		4613T-101-XXXX XX	4613T-106-XXXX XX	
11 12	1.098 (27.89)		14	4614T-102-XXXX XX	4614T-101-XXXX XX	4614T-106-XXXX XX	
13 14	1.298 (32.97) 1.398 (35.51)	202 330 47	15	SUI MAUDE	4615T-101-XXXX XX	4615T-106-XXXX XX	
15 16	1.498 (38:05) 1.598 (40.59)	1 888 188	16	4616T-102-XXXX XX	4616T-101-XXXX XX	4616T-106-XXXX XX	

Thin Film, Surface Mount Packages

Package Type	Series Number	Pin Ct.	Isolated Resistors	Bussed Resistors	Series Circuit	Page No.
SOL SMD Wide Body Gull Wing -295 ± .003 (7.493 ± .076)	502 555 533 533 533 534	16	4416T-001-XXXX XX	4416T-002-XXXX XX	182 105 - 101 222 101 222 102 102 102 102 102 102	-8800 (3900
######################################	4400T	20	4420T-001-XXXX XX	4420T-002-XXXX XX	901	130
SOM SMD Medium Body Gull Wing		14	4814T-001-XXXX XX	4814T-002-XXXX XX	ree HS te	
.220 ± .005 (5.59 ± .12)		16	4816T-001-XXXX XX	4816T-002-XXXX XX		SB(1)
300 ± .010 (7.62 ± .25)	4800T	18	4818T-001-XXXX XX	4818T-002-XXXX XX	200 301 301 301 301 301 301 301 301 301 3	132
(7.62 ± .25)	093 188 803	20	4820Ť-001-XXXX XX	4820T-002-XXXX XX	104 - 222 - 291 181	
SON SMD Narrow Body Gull Wing 050 ± .005 1.27 ± .127) - 016 ± .003 (41 ± .08)	128 381 4 228 271 - 1	8	4K08T-001-XXXX XX	4K08T-002-XXXX XX	08- 101 -830 102 -270 103 -270	PROTE
193 ± .003 BUBURUBUBUBUBUBUBUBUBUBUBUBUBUBUBUBUBUB	4K00T	14	4K14T-001-XXXX XX	4K14T-002-XXXX XX		134
4.90 ± .08) 341 ± .004 8.66 ± .10) 390 ± .004 9.91 ± .10)	220 330 222 331 23 27	16	4K16T-001-XXXX XX	4K16T-002-XXXX XX	931) - 70 T (



RESISTOR NETWORKS POPULAR RESISTANCE CODES

These resistance values are in stock and readily available through distribution.

Part Number			Re	sistar	nce C	odes			
4114R-001-	102 103 151	221 271	331	472			-73-08 -78-08		
4114R-002-	102 103 104	OF TOO	4607	472	300X	A-10. X-10.	AT Y (0.5		XX
4114R-003-	1000	101-100	1000	1 30	Xoox	X-rol	nece	221/	331
4116R-001-	101 102 103 104 105 121 122 151 152	223 224	331 332	470 471 472 473	300 300 300 300		7016 7118 7213 7618 7618		300 300
4116R-002-	102 103 104	222	316.8	472	562	Xero	-Jejle		
4116R-003-		, F.						221/	331
4306R-101-	101 102 103 104	222 271		472					
4306R-102-	103						Tab.		
4308R-101-	101 102 103 104 151	222		470 471 472 473					
4308R-102-	101 102 103 104 121	220 221 223 271		470 471 472	K 200	680	820	Ų.	X0
4308R-104-				×	K 300	02-20	odan	221/	
4310R-101-	101 102 103 104 121 151	203 221 222 223	331 332 333 391	473			0-F818		X
4310R-102-	101 102 103 104 152	220 270	330	470 471 472	(XIO	(4-5t)	7-7800	4	30
4310R-104-				10	(X00	X-80)-Tab	221/	
4416P-001-				470		7			
4416P-002-	103					200	1		Ų,
4416P-T01-				470					
4416P-T02-	103								

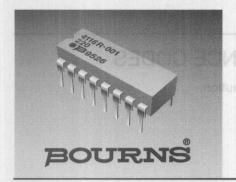
Part Number			Re	sistar	nce C	odes		
4420P-001-	102			470				neima e
4420P-002-	103			472		(ullicus	dgd b	
4420P-T01-	102			470	A.			
4420P-T02-	103	T Y		472	¥.			
4606X-101-	102 103 104	222 223 272	331	471 472 473	T ones	-7		#/
4606X-102	102 103			473				
4608X-101-	102 103 104	222	331 332	472 473	561			
4608X-102-	101 102 103 104 105 121 152	220 221 222 223 224	330 331 333 390	471 472 473		681	822 824	
4608X-104-								221/33 331/47
4610X-101-	101 102 103 104 105 151 152	203 221 222 223 224 271 272	332	471 472 473 474	561 562		S JOK YOUR SOLE	
4610X-102-	101 102 103 104 105 151	220	330	470 472 473			MARIN ARIN MOS MOS	Marthur
4610X-104-							-imi	221/33
4814P-001-	- 61	220	innas.				2 40 10	331/47
4814P-001-	103	203	331	472				
4814P-T01-	103	220	501	712			10 - 12	
4814P-T02-	103	203	331	472				
4816P-001-	101 102 103 104 152	220 222 223 271	330 331				820	vonsti · 農語
4816P-002-	101 102 103	222	004	472 473	E 20			
4816P-T01-	101 102 103 104 152	220 222 223 271		470 472	560	680	820	



RESISTOR NETWORKS POPULAR RESISTANCE CODES

These resistance values are in stock and readily available through distribution.

Part Number		Re	sistar	nce C	odes	1. A. W. (1) is
4816P-T02-	101 222 102 103		472 473			
4908P-001	101 203 102 220 103 221 104 222 151 223 152 270 181 271 272	331 332	470 471 472 473	560 561		820 822
4908P-002-	101 203 102 220 103 221 104 222 151 223 152 270 181 271 272	331 332 390	470 471 472 473	560 561	680	820 822
4914P-001-	101 203 102 220 103 221 104 222 151 223 152 270 181 271 272	331	470 471 472 473	561	680	820 822
4914P-002-	101 203 102 220 103 221 104 222 151 223 152 270 181 271 272	331	472 473	560 561		820 822
4916P-001-	101 203 102 220 103 221 104 222 151 223 152 270 181 271 272	331	470 471 472 473	560 561		820 8 S 822 S W W W W W W W W W W W W W W W W W W
4916P-002-	101 203 102 220 103 221 104 222 151 223 152 270 181 271 272		470 471 472 473	561	680	820 822



THICK FILM MOLDED DIPS 8, 14, 16, 18 AND 20 PIN

- Compatible with automatic insertion equipment
- Superior package integrity
- Marking on contrasting background for permanent identification

Model 4100R Series

B[®] Resistor Networks

Electrical Characteristics

Resistance Range
10 ohms to 10 megohms
Maximum Operating Voltage100V
Temperature Coefficient of Resistance
50Ω to 2.2 MΩ±100ppm/°C
below 50Ω±250ppm/°C
above 2.2 MΩ±250ppm/°C
TCR Tracking50ppm/°C
maximum; equal values
Resistor ToleranceSee circuits
Operating Temperature
-55°C to +125°C

Environmental Characteristi	cs
TESTS PER MIL-STD-202	ΔR MAX.
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering Heat	
	±0.25%
Terminal Strength	±0.25%
Thermal Shock	
Vibration	±0.25%
Insulation Resistance	
10,000 megohm	s minimum
Dielectric Withstanding Voltag	е
	200 VRMS

Physical Characteristics

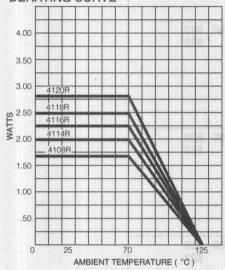
Lead Solderability

FlammabilityConforms to UL94V-0
Lead Frame Material
Copper, solder coated
Body Material
Novolac epoxy

.....Meet requirements of MIL-STD-202

Method 208

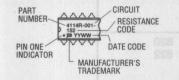
PACKAGE POWER TEMPERATURE **DERATING CURVE**

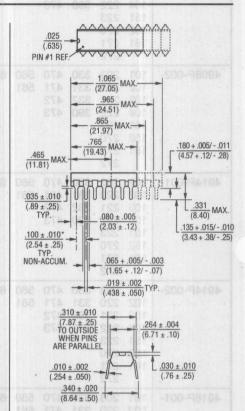


Package Power Rating at 70°C

4108R	1.69 watts
4114R	2.00 watts
4116R	2.25 watts
4118R	2.50 watts
4120R	2.80 watts

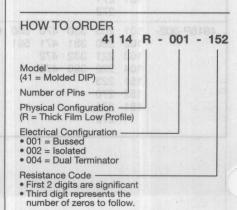
TYPICAL PART MARKING Represents total content. Layout may vary.





Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.



Consult factory for other available options.

Specifications are subject to change without notice.

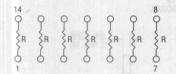
THICK FILM MOLDED SIPS, LOW PROFILE 6, 8, 9, 10, AND 11 PIN

Low profile provides compatibility with DIPs
 Compatible with automatic insertion equipment
 Superior package integrity

Model 4100R Series

B[®] Resistor Networks

ISOLATED RESISTORS
(001 CIRCUIT)
Model 4108R-001-RC
(4 Isolated Resistors)
Model 4114R-001-RC
(7 Isolated Resistors)
Model 4116R-001-RC
(8 Isolated Resistors)
Model 4118R-001-RC
(9 Isolated Resistors)
Model 4120R-001-RC
(10 Isolated Resistors)



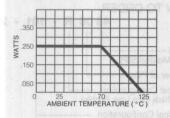
Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms	£2%*
Above 5 megohms	±5%

Power Rating per Resistor

At 70°C0.250 watt

POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (002 CIRCUIT)

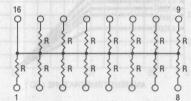
Model 4108R-002-RC (7 Resistors, Pin 8 Common)

Model 4114R-002-RC (13 Resistors, Pin 14 Common)

Model 4116R-002-RC (15 Resistors, Pin 16 Common)

Model 4118R-002-RC (17 Resistors, Pin 18 Common)

Model 4120R-002-RC (19 Resistors, Pin 20 Common)



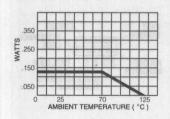
Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms±	2%*
Above 5 megohms	±5%

Power Rating per Resistor

At 70°C0.125 watt

POWER TEMPERATURE DERATING CURVE



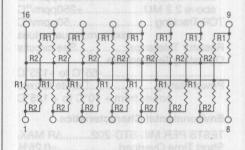
DUAL TERMINATOR (003 CIRCUIT)

Model 4108R-003-R1/R2

Model 4114R-003-R1/R2 Model 4116R-003-R1/R2 (shown)

Model 4118R-003-R1/R2

Model 4120R-003-R1/R2

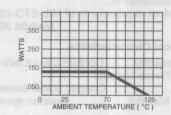


Resistance Tolerance

Below to 100 ohms±2	ohms
100 ohms to 5 megohms	±2%*
Above 5 megohms	

Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (001, 002 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1.800	182	15.000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22.000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	680	681	5,600	562	47,000	473	470,000	474
82	820	820	821	6,800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1,000,000	105

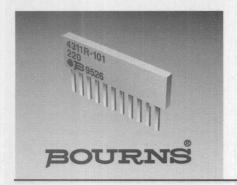
^{* ±1%} Tolerance is available by adding suffix code "F" after the resistance code.

Specifications are subject to change without notice.

RESISTANCE VALUES (003 CIRCUIT)**

	Resis	tance		
(OI	nms)	Code		
R ₁	R ₂	R ₁	R ₂	
160	240	161	241	
180	390	181	391	
220	270	221	271	
220	330	221	331	
330	390	331	391	
330	470	331	471	
3,000	6,200	302	622	

^{**}Non-standard values available, within resistance range.



THICK FILM MOLDED SIPs, LOW PROFILE 6, 8, 9, 10, AND 11 PIN

- Low profile provides compatibility with DIPs
- Compatible with automatic insertion equipment
- Superior package integrity
- Marking on contrasting background for permanent identification
- Top marking standard

Model 4300R Series

B[®] Resistor Networks

Electrical Characteristics

Resistance Range10 ohms to 10 megohms Maximum Operating Voltage.....100V Temperature Coefficient of Resistance 50Ω to 2.2 MΩ.....±100ppm/°C below 50Ω.....±250ppm/°C above 2.2 MΩ.....±250ppm/°C TCR Tracking50ppm/°C maximum; equal values Resistor ToleranceSee circuits **Operating Temperature**-55°C to +125°C Power RatingDerate to zero power from + 70°C to + 125°C

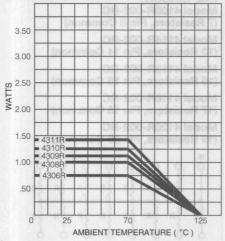
Environmental Characteristics

TESTS PER MIL-STD-202	ΔR MAX.
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering Hea	at
and the second s	±0.25%
Terminal Strength	±0.25%
Thermal Shock	±0.25%
Vibration	±0.25%
Insulation Resistance	
10,000 megoh	ms minimum
Dielectric Withstanding Volta	age
	200 VRMS
Lead Solderability	A STATE STATE OF STAT
Meet requirements of N	MIL-STD-202
	Method 208

Physical Characteristics

i ilyolodi ollardoto	110000
Flammability	Conforms to UL94V-0
Lead Frame Materia	al
C	copper, solder coated
Body Material	Novolac epoxy

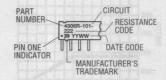
PACKAGE POWER TEMPERATURE **DERATING CURVE**

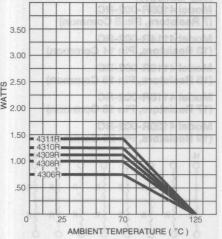


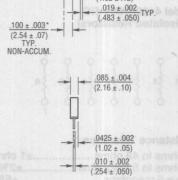
Package Power Rating at 70°C

4306R	0.75 watts
4308R	1.00 watts
4309R	1.13 watts
4310R	1.25 watts
4311R	1.38 watts

TYPICAL PART MARKING Represents total content. Layout may vary.







 $\frac{1.084}{(27.53)}$ MAX.

.584 (14.83) MAX

(22.45)

.016 + .004/ - 000

(407 + 102/ - 000

- MAX-(24.99)

(1.02 ± .12)

(4.95)

MAX.

.135 + .015/ - .010

(3.43 + .38 / - .25)

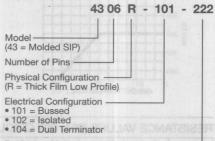
(19.92) MAX.

PIN #1 REF.

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER



Resistance Code

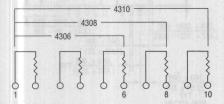
First 2 digits are significant
Third digit represents the number of zeros to follow.

Consult factory for other available options.

Model 4300R Series

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT) Model 4306R-102-RC (6 Pin) Model 4308R-102-RC (8 Pin) Model 4310R-102-RC (10 Pin)



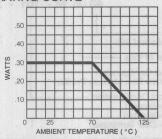
These models incorporate 3, 4 or 5 isolated thick-film resistors of equal value, each connected between two pins.

Resistance Tolerance

10 ohms	to 49	ohms		±1	ohm
50 ohms	to 5	megoh	ms	±	2%*

Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE



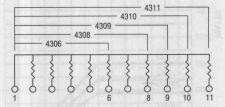
BUSSED RESISTORS (101 CIRCUIT)

Madium profile offers intregased cower handling

a Marking on contrasting background for permanent identification

whoeth somiting temperal w

Model 4306R-101-RC (6 Pin) Model 4308R-101-RC (8 Pin) Model 4309R-101-RC (9 Pin) Model 4310R-101-RC (10 Pin) Model 4311R-101-RC (11 Pin)



These models incorporate 5, 7, 8, 9 or 10 thick-film resistors of equal value, each connected between a separate pin.

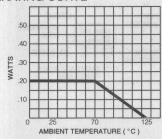
Resistance Tolerance

10 ohms to 49 ohms±1 o	hm
50 ohms to 5 megohms±2	1%*
Above 5 megohms±	

Power Rating per Resistor

At 70°C0.20 watt

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (101, 102 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	680	681	5,600	562	47,000	473	470,000	474
82	820	820	821	6,800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1,000,000	105

^{* ±1%} Tolerance is available by adding suffix code "F" after the resistance code.

DUAL TERMINATOR (104 CIRCUIT)

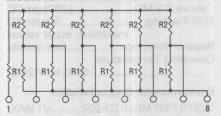
Model 4306R-104-R1/R2

Model 4308R-104-R1/R2 (shown)

Model 4309R-104-R1/R2

Model 4310R-104-R1/R2

Model 4311R-104-R1/R2



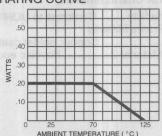
4308R-104 (shown above) is an 8-pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thick-film resistors are paired in series be-tween the common lines (pins 1 and 8).

Resistance Tolerance

Below 100 ohms±2	ohms
100 ohms to 5 megohms	±2%*
Above 5 megohms	

Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE

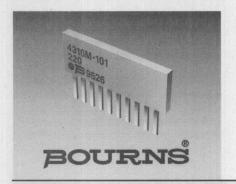


RESISTANCE VALUES (104 CIRCUIT)**

	Resis	tance	
(0)	nms)	Co	de
R ₁	R ₂	R ₁	R ₂
160 180 220 220 330 330	240 390 270 330 390 470	161 181 221 221 331 331	241 391 271 331 391 471
3,000	6,200	302	622

^{**}Non-standard values available, within resistance range.

Specifications are subject to change without notice.



THICK FILM MOLDED SIPs, MEDIUM PROFILE 4, 6, 8 AND 10 PIN

- Medium profile offers increased power handling
- Compatible with automatic insertion equipment
- Superior package integrity
- Marking on contrasting background for permanent identification
- Top marking standard

Model 4300M Series

B[®] Resistor Networks

Electrical Characteristics

Resistance Range
10 ohms to 10 megohms
Maximum Operating Voltage100V
Temperature Coefficient of Resistance
50Ω to 2.2 MΩ±100ppm/°C
below 50Ω±250ppm/°C
above 2.2 MΩ±250ppm/°C
TCR Tracking50ppm/°C
maximum; equal values
Resistor ToleranceSee circuits
Operating Temperature
55°C to +125°C

Environmental Characterist	tics
TESTS PER MIL-STD-202	ΔR MAX.
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	
Moisture Resistance	±0.50%
Resistance to Soldering Heat	trick-tim ret
	±0.25%
Terminal Strength	±0.25%
Thermal Shock	
Vibration	
Insulation Resistance	
10,000 megohn	ns minimum
Dielectric Withstanding Volta	ge
	200 VRMS

Physical Characteristics

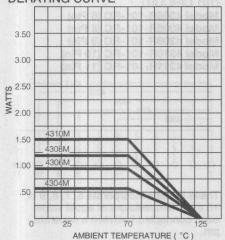
Lead Solderability

FlammabilityConforms to UL94V-0
Lead Frame Material
Copper, solder coated
Body MaterialNovolac epoxy

.....Meet requirements of MIL-STD-202

Method 208

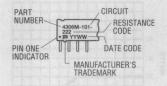
PACKAGE POWER TEMPERATURE DERATING CURVE

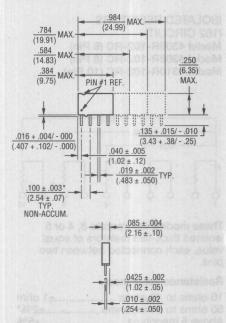


Package Power Rating at 70°C

4304M	0.60 watts
4306M	0.90 watts
4308M	1.20 watts
4310M	1.50 watts

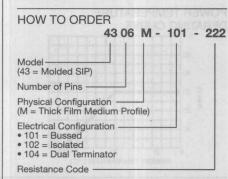
TYPICAL PART MARKING Represents total content. Layout may vary.





Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.



• First 2 digits are significant

 Third digit represents the number of zeros to follow.

Consult factory for other available options.

THICK FILM MOLDED SIPS, HIGH PROFILE 4, 6, 8, AND 10 PIN

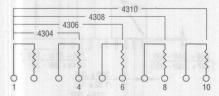
marking standard

Model 4300M Series

B® Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT)

Model 4304M-102-RC (4 Pin) Model 4306M-102-RC (6 Pin) Model 4308M-102-RC (8 Pin) Model 4310M-102-RC (10 Pin)



These models incorporate 2, 3, 4, or 5 isolated thick-film resistors of equal value, each connected between two pins.

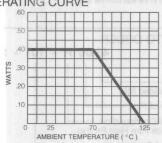
Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms	±2%*
Above 5 megohms	

Power Rating per Resistor

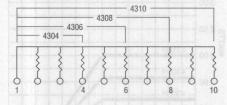
At 70°C0.40 watt

POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (101 CIRCUIT)

Model 4304M-101-RC (4 Pin)
Model 4306M-101-RC (6 Pin)
Model 4308M-101-RC (8 Pin)
Model 4310M-101-RC (10 Pin)



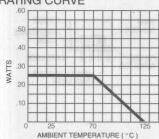
These models incorporate 3, 5, 7, or 9 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

Resistance Tolerance

10 ohms to 49 ohms±	1 ohm
50 ohms to 5 megohms	±2%*
Above 5 megohms	

Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (101, 102 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	680	681	5,600	562	47,000	473	470,000	474
82	820	820	821	6,800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1,000,000	105

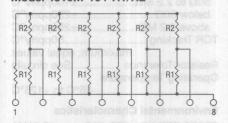
* ±1% Tolerance is available by adding suffix code "F" after the resistance code.

**Non-standard values available, within resistance range.

Specifications are subject to change without notice.

DUAL TERMINATOR (104 CIRCUIT)

Model 4304M-104-R1/R2 Model 4306M-104-R1/R2 Model 4308M-104-R1/R2 (shown) Model 4310M-104-R1/R2



4308M-104 (shown above) is an 8-pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thickfilm resistors are paired in series between the common lines (pins 1 and 8)

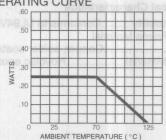
Resistance Tolerance

Below 100 ohms±2	ohms
100 ohms to 5 megohms	±2%*
Above 5 megohms	±5%

Power Rating per Resistor

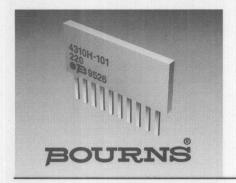
At 70°C0.25 watt

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (104 CIRCUIT)**

	Resis	tance	
(OI	nms)	Co	de
R ₁	R ₂	R ₁	R ₂
160	240	161	241
180	390 270	181 221	391 271
220	330	221	331
330 330	390 470	331 331	391 471
3,000	6,200	302	622



THICK FILM MOLDED SIPs, HIGH PROFILE 4, 6, 8, AND 10 PIN

- High profile offers increased power handling
- Compatible with automatic insertion equipment
- Superior package integrity
- Marking on contrasting background for permanent identification
- Top marking standard

Model 4300H Series

B[®] Resistor Networks

Electrical Characteristics

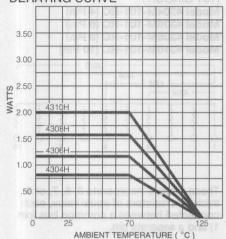
Resistance Range
10 ohms to 10 megohms
Maximum Operating Voltage100V
Temperature Coefficient of Resistance
50Ω to 2.2 MΩ±100ppm/°C
below 50Ω±250ppm/°C
above 2.2 MΩ±250ppm/°C
TCR Tracking50ppm/°C
maximum; equal values
Resistor ToleranceSee circuits
Operating Temperature
-55°C to +125°C

55°C	to +125°C
Environmental Characterist	ics
TESTS PER MIL-STD-202	ΔR MAX
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering Heat	
bas Fesio) será contribo s	±0.25%
Terminal Strength	±0.25%
Thermal Shock	
Vibration	±0.25%
VibrationInsulation Resistance	
10,000 megohm	s minimum
Dielectric Withstanding Voltage	ge
	.200 VRMS
Lead Solderability	
Meet requirements of M	IL-STD-202
	Method 208

Dhysical Characteristics

Filysical Characteristics
FlammabilityConforms to UL94V-0
Lead Frame Material
Copper, solder coated
Body MaterialNovolac epoxy

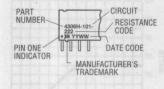
PACKAGE POWER TEMPERATURE **DERATING CURVE**

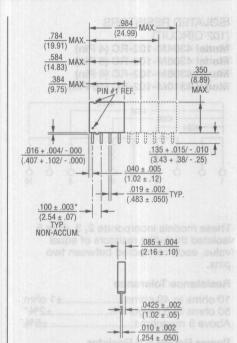


Package Power Rating at 70°C

4304H	0.80 watts
4306H	1.20 watts
4308H	1.60 watts
4310H	2.00 watts

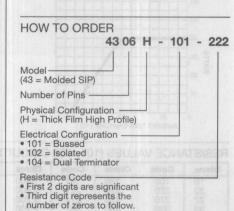
TYPICAL PART MARKING Represents total content. Layout may vary.





Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.



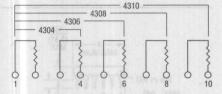
Consult factory for other available options.

Model 4300H Series

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT)

Model 4304H-102-RC (4 Pin) Model 4306H-102-RC (6 Pin) Model 4308H-102-RC (8 Pin) Model 4310H-102-RC (10 Pin)



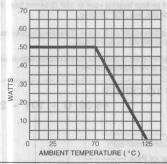
These models incorporate 2, 3, 4, or 5 isolated thick-film resistors of equal value, each connected between two

Resistance Tolerance

10 ohms to 49 ohms±1 o	
50 ohms to 5 megohms±	2%*
Above 5 megohms	

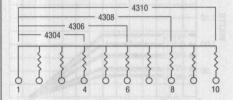
Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (101 CIRCUIT)

Model 4304H-101-RC (4 Pin) Model 4306H-101-RC (6 Pin) Model 4308H-101-RC (8 Pin) Model 4310H-101-RC (10 Pin)



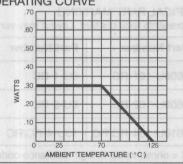
These models incorporate 3, 5, 7, or 9 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

Resistance Tolerance

10 ohms to 49 ohms±	1 ohm
50 ohms to 5 megohms	±2%*
Above 5 megohms	

Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (101 102 CIRCUITS)**

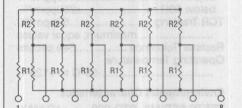
Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	. 680	681	5,600	562	47,000	473	470,000	474
82	820	820	821	6.800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1.000,000	105

* ±1% Tolerance is available by adding suffix code "F" after the resistance code.
**Non-standard values available, within resistance range.

Specifications are subject to change without notice.

DUAL TERMINATOR (104 CIRCUIT)

Model 4304H-104-R1/R2 Model 4306H-104-R1/R2 Model 4308H-104-R1/R2 (shown) Model 4310H-104-R1/R2



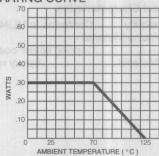
4308H-104 (shown above) is an 8-pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thickfilm resistors are paired in series between the common lines (pins 1 and 8).

Resistance Tolerance

Below 100 ohms±2	ohms
100 ohms to 5 megohms	.±2%*
Above 5 megohms	+5%

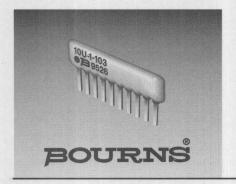
Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (104 CIRCUIT)**

	Resis	tance	
(Ohms) Co			
R ₁	R ₂	R ₁	R ₂
160	240	161	241
180	390	181	391
220	270	221	271
220	330	221	331
330	390	331	391
330	470	331	471
3,000	6,200	302	622



THICK FILM CONFORMAL SIPs **ULTRALOW PROFILE, 4 THROUGH 12 PIN**

- Low profile is compatible with DIPs
- Wide assortment of pin packages enhances design flexibility
- Recommended for rosin flux and solvent clean or no clean flux processes

Model 4600U

B[®] Resistor Networks

Electrical Characteristics

Resistance Range10 ohms to 2.2 megohms Maximum Operating Voltage.....50V Temperature Coefficient of Resistance 50Ω to 2.2 MΩ.....±100ppm/°C below 50Ω±250ppm/°C TCR Tracking50ppm/°Cmaximum; equal values Resistor ToleranceSee circuits Operating Temperature-55°C to +125°C

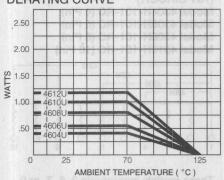
Environmental Characterist	ics
TESTS PER MIL-STD-202	AR MAX.
Short Time Overload	±0.25%
Load Life	
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering Heat	
brig f and seal northoos	±0.25%
Terminal Strength	±0.25%
Thermal Shock	
Vibration	±0.25%
Insulation Resistance	
10,000 megohm	
Dielectric Withstanding Voltage	ge
TOTAL PORT THE DAY	
Lead Solderability	
Meet requirements of MI	L-STD-202
	Method 208

Physical Characteristics

FlammabilityConforms to UL94V-0 Lead Frame MaterialCopper, solder coated

Body Material.....Epoxy resin

PACKAGE POWER TEMPERATURE **DERATING CURVE**



Package Power Ratings (Watts)

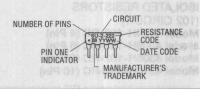
Pkg.	Ambient Temperature 70°C	Pkg.	Ambient Temperature 70°C
4604U	0.40	4610U	1.00
4605U	0.50	4611U	1.10
4606U	0.60	4612U	1.20
4607U	0.70		
4608U	0.80		
4609U	0.90		

TYPICAL PART MARKING

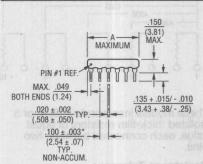
Represents total content. Layout may vary.

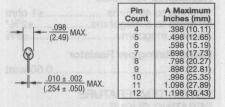
Part Number	Part Number
4606U-101-RC	6U-1-RC
4608U-102-RC	8U-2-RC
4610U-104-RC/RC	10U-4-RC/RC

RC = ohmic value, 3-digit resistance code.



Model 4300H Series





Maximum package length is equal to .100" (2.54mm) times the number of pins, less .002" (.005mm.)

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER 46 06 U - 101 - 222 (46 = Conformal SIP) Number of Pins Physical Configuration (U = Thick Film Ultralow Profile) **Electrical Configuration**

•101 = Bussed •102 = Isolated •104 = Dual Terminator

Resistance Code

• First 2 digits are significant •Third digit represents the number of zeros to follow.

Consult factory for other available options.

Specifications are subject to change without notice.

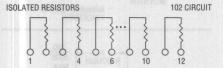
THICK FILM CONFORMAL SIPS, LOW PROFILE 4 THROUGH 16 PIN

Wide assortment of pin packages entrances design flexibility
 Ammo-pak packaging available
 Recommended for rosin flux and solvent clean or no clean

Model 4600U

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT) Model 4600U-102-RC 4, 6, 8, 10 or 12 Pin

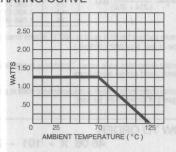


These models incorporate 2 to 6 isolated thick-film resistors of equal value, each connected between two pins.

Resistance Tolerance

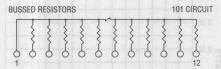
10	ohms	to	49	ohms		±	1 ohm
50	ohms	to	2.2	mega	hms		.±2%

POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (101 CIRCUIT) Model 4600U-101-RC

Model 4600U-101-R0 4 through 12 Pin

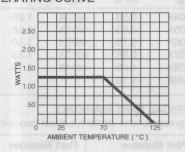


These models incorporate 3 to 11 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

Resistance Tolerance

10 ohms	to	49 ohms±1	ohm
50 ohms	to	2.2 megohms	±2%*

POWER TEMPERATURE DERATING CURVE



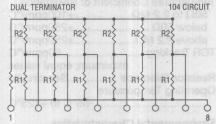
RESISTANCE VALUES (101, 102 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	680	681	5,600	562	47,000	473	470,000	474
82	820	820	821	6,800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1,000,000	105

^{* ±1%} Tolerance is available by adding suffix code "F" after the resistance code.

**Non-standard values available, within resistance range.

DUAL TERMINATOR (104 CIRCUIT) Model 4600U-104-R1/R2. 4 through 12 Pin

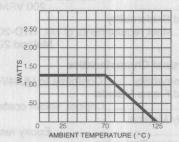


The 4608U-104 (shown above) is an 8-pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thick-film resistors are paired in series between the common lines (pins 1 and 8).

Resistance Tolerance

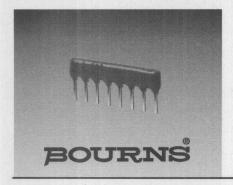
Below 100 ohms±2	ohms
100 ohms to 2.2 megohms	±2%

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (104 CIRCUIT)**

	Resis	tance	
(Oh	ms)	Co	de
R ₁	R ₂	R ₁	R ₂
160 180 220 220 330 330 3,000	240 390 270 330 390 470 6,200	161 181 221 221 331 331 302	241 391 271 331 391 471 622



THICK FILM CONFORMAL SIPs, LOW PROFILE 4 THROUGH 16 PIN

- Low profile is compatible with DIPs
- Wide assortment of pin packages enhances design flexibility
- Ammo-pak packaging available
- Recommended for rosin flux and solvent clean or no clean flux processes
- Marking on contrasting background for permanent identification

Model 4600X

B[®] Resistor Networks

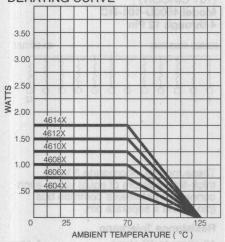
Electrical Characteristics

Resistance Range10 ohms to 10 megohms Maximum Operating Voltage.....100V Temperature Coefficient of Resistance 50Ω to 2.2 MΩ....±100ppm/°C below 50Ω.....±250ppm/°C above 2.2 MΩ.....±250ppm/°C TCR Tracking50ppm/°C maximum; equal values Resistor ToleranceSee circuits **Operating Temperature**-55°C to +125°C

Environmental Characteristics	
TESTS PER MIL-STD-202 AR Short Time Overload ± Load Life ± Mechanical Shock ± Moisture Resistance ± Resistance to Soldering Heat	0.25% 1.00% 0.25%
±	0.25%
Terminal Strength±	0.25%
Thermal Shock±	
Vibration± Insulation Resistance	0.25%
10,000 megohms mir Dielectric Withstanding Voltage	
Lead Solderability	VRMS
Meet requirements of MIL-ST	D-202
Metho	

Physical Characteristics

PACKAGE POWER TEMPERATURE **DERATING CURVE**



Package Power Ratings (Watts)

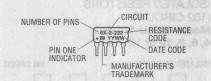
Pkg.	Ambient Temperature 70°C	Pkg.	Ambient Temperature 70°C
4604X	0.50	4610X	1.25
4605X	0.63	4611X	1.38
4606X	0.75	4612X	1.50
4607X	0.88	4613X	1.63
4608X	1.00	4614X	1.75
4609X	1.13		

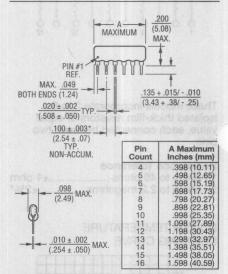
TYPICAL PART MARKING

Represents total content. Layout may vary.

Part Number	Part Number		
4606X-101-RC	6X-1-RC		
4608X-102-RC	8X-2-RC		
4610X-104-RC/RC	10X-4-RC/RC		

RC = ohmic value, 3-digit resistance code.



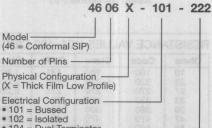


Maximum package length is equal to .100" (2.54mm) times the number of pins, less .002" (.005mm.)

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER



- 104 = Dual Terminator
- AP1 = Bussed Ammo
- AP2 = Isolated Ammo
- AP4 = Dual Ammo

· First 2 digits are significant

· Third digit represents the number of zeros to follow

Consult factory for other available options.

Wide assortment of pin packages enhances design flexibility

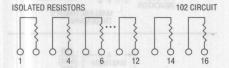
a Ammo-pak paokaging available a Recommended for rosin flux and solvent clean or no clean

Marking on contrasting background for permanent identification

Model 4600X

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT) Model 4600X-102-RC 4, 6, 8, 10, 12 or 16 Pin



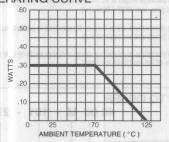
These models incorporate 2 to 8 isolated thick-film resistors of equal value, each connected between two

Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms	±2%*
Above 5 megohms	±5%

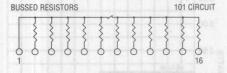
Power Rating per Resistor

POWER TEMPERATURE **DERATING CURVE**



BUSSED RESISTORS (101 CIRCUIT)

Model 4600X-101-RC 4 through 16 Pin



These models incorporate 3 to 15 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

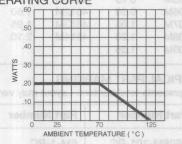
Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms	±2%*
Above 5 megohms	.±5%

Power Rating per Resistor

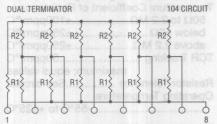
At 70°C0.20 watt

POWER TEMPERATURE **DERATING CURVE**



DUAL TERMINATOR (104 CIRCUIT) Model 4600X-104-R1/R2

4 through 16 Pin



The 4608X-104 (shown above) is an 8pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thick-film resistors are paired in series between the common lines (pins 1 and 8).

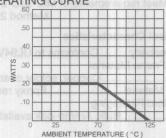
Resistance Tolerance

Below 100 ohms±2	ohms
100 ohms to 5 megohms	±2%*
Above 5 megohms	

Power Rating per Resistor

At 70°C0.20 watt

POWER TEMPERATURE **DERATING CURVE**



RESISTANCE VALUES (101, 102 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	680	681	5,600	562	47,000	473	470,000	474
82	820	820	821	6.800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1.000,000	105

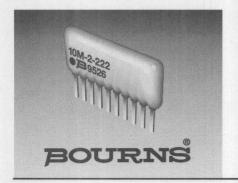
* ±1% Tolerance is available by adding suffix code "F" after the resistance code.

Specifications are subject to change without notice.

**Non-standard values available, within resistance range.

RESISTANCE VALUES (104 CIRCUIT)**

	Resis	tance			
(0)	(Ohms)		(Ohms)		de
R ₁	R ₂	R ₁	R ₂		
160	240	161	241		
180	390	181	391		
220	270	221	271		
220	330	221	331		
330	390	331	391		
330	470	331	471		
3,000	6,200	302	622		



THICK FILM CONFORMAL SIPs MEDIUM PROFILE, 4 THROUGH 16 PIN

- Medium profile offers increased power handling
- Wide assortment of pin packages enhances design flexibility
- Ammo-pak packaging available
- Recommended for rosin flux and solvent clean or no clean flux processes
- Marking on contrasting background for permanent identification

Model 4600M

B[®] Resistor Networks

Electrical Characteristics

Standard Resistance Values
10 ohms to 10 megohms
Maximum Operating Voltage100V
Temperature Coefficient of Resistance
50Ω to 2.2 MΩ±100ppm/°C
below 50Ω±250ppm/°C
above 2.2 MΩ±250ppm/°C
TCR Tracking50ppm/°C
maximum; equal values
Resistor ToleranceSee circuits
Operating Temperature
-55°C to +125°C

Environmental Characteristics

TESTS PER MIL-STD-202	AR MAX.
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering Heat	

	±0.25%
Terminal Strength	±0.25%
Thermal Shock	±0.25%
Vibration	±0.25%
Insulation Resistance	Payer Rating

.....10,000 megohms minimum Dielectric Withstanding Voltage200 VRMS

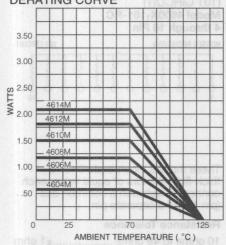
Lead SolderabilityMeet requirements of MIL-STD-202 Method 208

Physical Characteristics

Lead Frame	Vlaterial
	Copper, solder coated
Body Materia	IEpoxy resir
Standard Pa	kaging
	Rulk Ammo-nak available

FlammabilityConforms to UL94V-0

PACKAGE POWER TEMPERATURE **DERATING CURVE**



Package Power Ratings (Watts)

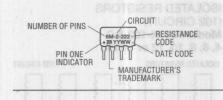
	Ambient Temperature		Ambient Temperature
Pkg.	70°C	Pkg.	70°C
4604M	0.60	4610M	1.50
4605M	0.75	4611M	1.65
4606M	0.90	4612M	1.80
4607M	1.05	4613M	1.95
4608M	1.20	4614M	2.10
4609M	1.35		

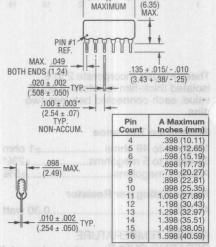
TYPICAL PART MARKING

Represents total content. Layout may vary.

Part Number	Part Number
4606M-101-RC	6M-1-RC
4608M-102-RC	8M-2-RC
4610M-104-RC/RC	10M-4-RC/RC

RC = ohmic value, 3-digit resistance code.





Maximum package length is equal to .100" (2.54mm) times the number of pins, less .002" (.005mm.)

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER

46 06 M - 101 - 222

Model — (46 = Conformal SIP) Number of Pins Physical Configuration (M = Thick Film Medium Profile)

Electrical Configuration • 101 = Bussed

- 102 = Isolated
- 104 = Dual Terminator
- AP1 = Bussed Ammo AP2 = Isolated Ammo AP4 = Dual Ammo

Resistance Code

First 2 digits are significant
Third digit represents the number of zeros to follow.

Consult factory for other available options.

Specifications are subject to change without notice.

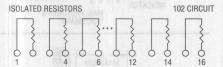
THICK RILM CONFORMAL SIPS, HIGH PROFILE 4 THROUGH 14 PIN

Ammo-pak packaging available
 Recommended for rosin flux and solvent clean or no clean
 flux processes.

Model 4600M

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT) Model 4600M-102-RC 4, 6, 8, 10, 12, 14 or 16 Pin



These models incorporate 2 to 8 isolated thick-film resistors of equal value, each connected between two pins.

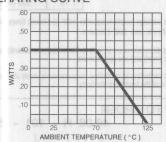
Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms	±2%*
Above 5 megohms	±5%

Power Rating per Resistor

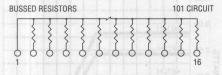
At 70°C0.40 watt

POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (101 CIRCUIT) Model 4600M-101-RC

Model 4600M-101-RC 4 through 16 Pin



These models incorporate 3 to 15 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

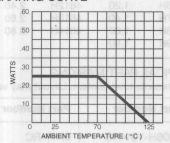
Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms	£2%*
Above 5 megohms	±5%

Power Rating per Resistor

At	70°C	0.2	25	wat

POWER TEMPERATURE DERATING CURVE



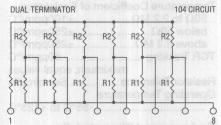
RESISTANCE VALUES (101, 102 CIRCUITS)**

0	hms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
	10	100	180	181	1,800	182	15,000	153	120.000	124
	22	220	220	221	2,000	202	18,000	183	150,000	154
	27	270	270	271	2,200	222	20,000	203	180,000	184
	33	330	330	331	2,700	272	22,000	223	220,000	224
	39	390	390	391	3,300	332	27,000	273	270,000	274
	47	470	470	471	3,900	392	33.000	333	330,000	334
	56	560	560	561	4,700	472	39,000	393	390,000	394
	68	680	680	681	5,600	562	47,000	473	470,000	474
	82	820	820	821	6.800	682	56,000	563	560,000	564
	100	101	1,000	102	8,200	822	68,000	683	680,000	684
	120	121	1,200	122	10,000	103	82,000	823	820,000	824
	150	151	1,500	152	12,000	123	100,000	104	1,000,000	105

^{* ±1%} Tolerance is available by adding suffix code "F" after the resistance code.

Specifications are subject to change without notice.

DUAL TERMINATOR (104 CIRCUIT) Model 4600M-104-R1/R2 4 through 16 Pin



The 4608M-104 (shown above) is an 8-pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thick-film resistors are paired in series between the common lines (pins 1 and 8).

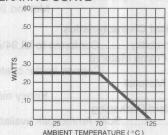
Resistance Tolerance

Below 100 ohms±2	ohms
100 ohms to 5 megohms	±2%*
Above 5 megohms	±5%

Power Rating per Resistor

At 70°C	Lane tield restricts the bitter	0	25	wat

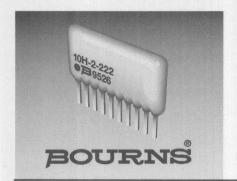
POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (104 CIRCUIT)**

Resistance				
(01	nms)	Co	de	
R ₁	R ₂	R ₁	R ₂	
160	240	161	241	
180	390	181	391	
220	270	221	271	
220	330	221	331	
330	390	331	391	
330	470	331	471	
3,000	6,200	302	622	

^{**}Non-standard values available, within resistance range.



THICK FILM CONFORMAL SIPs, HIGH PROFILE 4 THROUGH 14 PIN

- High profile offers increased power handling
- Wide assortment of pin packages enhances design flexibility
- Ammo-pak packaging available
- Recommended for rosin flux and solvent clean or no clean flux processes
- Marking on contrasting background for permanent identification

Model 4600H

B[®] Resistor Networks

Electrical Characteristics

nesistance hange	
10 ohm	s to 10 megohms
Maximum Operating Vo	
Temperature Coefficien	t of Resistance
50Ω to 2.2 M Ω	±100ppm/°C
below 50Ω	±250ppm/°C
above 2.2 MΩ	±250ppm/°C
TCR Tracking	50ppm/°C
maxim	num; equal values
Resistor Tolerance	See circuits
Operating Temperature	
	-55°C to +125°C

Environmental Characteristics

TESTS PER MIL-STD-202	∆R MAX.
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering Heat	
	0.050/

Resistance to Soldering Heat	Commission of the
	±0.25%
Terminal Strength	±0.25%
Thermal Shock	±0.25%
Vibration	±0.25%
Insulation Resistance	

.....10,000 megohms minimum Dielectric Withstanding Voltage200 VRMS

Lead SolderabilityMeet requirements of MIL-STD-202 Method 208

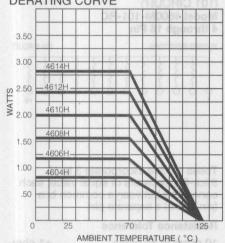
Physical Characteristics

FlammabilityConforms to UL94V-0
Lead Frame Material
Copper, solder coated
Rody Material

.....Epoxy resin Standard Packaging

.....Bulk, Ammo-pak available

PACKAGE POWER TEMPERATURE **DERATING CURVE**



Package Power Ratings (Watts)

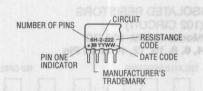
Pkg.	Ambient Temperature 70°C	Pkg.	Ambient Temperature 70°C
4604H	0.80	4610H	2.00
4605H	1.00	4611H	2.20
4606H	1.20	4612H	2.40
4607H	1.40	4613H	2.60
4608H	1.60	4614H	2.80
4609H	1.80		

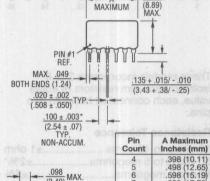
TYPICAL PART MARKING

Represents total content. Layout may vary.

Part Number	Part Number
4606H-101-RC	6H-1-RC
4608H-102-RC	8H-2-RC
4610H-104-RC/RC	10H-4-RC/RC

RC = ohmic value, 3-digit resistance code.





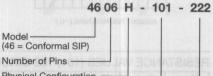
4 5 6	.398 (10.11) .498 (12.65)
5	
6	
	.598 (15.19)
7	.698 (17.73)
8	.798 (20.27)
	.898 (22.81)
	.998 (25.35)
11	1.098 (27.89)
12	1.198 (30.43)
	1.298 (32.97)
1/	1.398 (35.51)
15	1.498 (38.05)
	1.598 (40.59)
10	1.596 (40.59)
	7 8 9 10 11 12 13 14 15 16

Maximum package length is equal to .100" (2.54mm) times the number of pins, less .002" (.005mm.)

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER



Physical Configuration —— (H = Thick Film High Profile)

Electrical Configuration

- 101 = Bussed 102 = Isolated
- 104 = Dual TerminatorAP1 = Bussed Ammo
- AP2 = Isolated Ammo
 AP4 = Dual Ammo

- Resistance Code

 First 2 digits are significant
- Third digit represents the

number of zeros to follow.

Specifications are subject to change without notice.

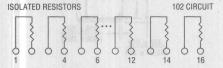
Consult factory for other available options.

THICK FILM SURFACE MOUNTED WIDE BODY (7.49MM) MOLDED SOL STYLE / 16 AND 20 PINS

Model 4600H

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT) Model 4600H-102 4, 6, 8, 10, 12 or 16 Pin



These models incorporate 2 to 8 isolated thick-film resistors of equal value, each connected between two pins.

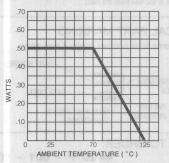
Resistance Tolerance

10 ohms to 49 ohms±1	ohm
50 ohms to 5 megohms±	2%*
Above 5 megohms	5%

Power Rating per Resistor

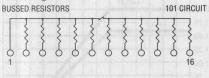
At 70°C0.50 watt

POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (101 CIRCUIT)

Model 4600H-101-RC 4 through 16 Pin



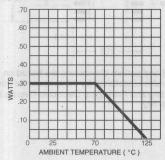
These models incorporate 3 to 15 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

Resistance Tolerance

10 ohms to 49 ohms±	ohm
50 ohms to 5 megohms	±2%*
Above 5 megohms	.±5%

Power Rating per Resistor

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (101, 102 CIRCUITS)**

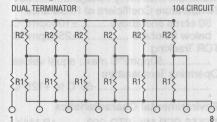
Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	680	681	5,600	562	47,000	473	470,000	474
82	820	820	821	6,800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1,000,000	105

* ±1% Tolerance is available by adding suffix code "F" after the resistance code.

**Non-standard values available, within resistance range.

Specifications are subject to change without notice.

DUAL TERMINATOR (104 CIRCUIT) Model 4600H-104-R1/R2 4 through 16 Pin



The 4608H-104 (shown above) is an 8-pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thick-film resistors are paired in series between the common lines (pins 1 and 8).

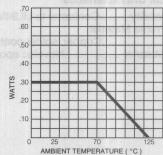
Resistance Tolerance

Below 100 ohms±2	ohms
100 ohms to 5 megohms	.±2%
Above 5 megohms	

Power Rating per Resistor

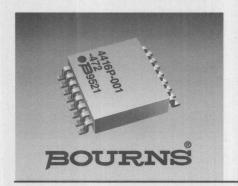
At 70°C0.30 watt

POWER TEMPERATURE DERATING CURVE



RESISTANCE VALUES (104 CIRCUIT)**

	Resis	tance	
(Oh	ms)	Co	de
R ₁	R ₂	R ₁	R ₂
160	240	161	241
180	390	181	391
220	270	221	271
220	330	221	331
330	390	331	391
330	470	331	471
3,000	6,200	302	622



THICK FILM SURFACE MOUNTED WIDE BODY (7.49MM) MOLDED SOL STYLE / 16 AND 20 PINS

- Standard E.I.A. package compatible with automatic placement equipment
- Compliant leads to reduce solder joint fatiguing
- Tape and reel packaging standard (see page 114 for dimensions)
- Marking on contrasting background for permanent identification

Model 4400P

▶® Resistor Networks

Electrical Characteristics

......50ppm/°C max.; equal values
Operating Temperature
......55°C to +125°C

Environmental Characteristics

TESTS PER MIL-STD-202	ΔH MAX.
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering Heat	DIE EXUIEIBU
	±0.25%

Thermal Shock.....±0.25% Insulation Resistance10,000 megohms min. Dielectric Withstanding Voltage

......200 VRMS
Lead Solderability
.....Meet requirements of MIL-STD-202

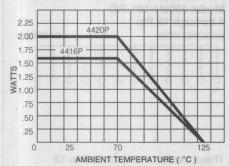
Method 208

Physical Characteristics

FlammabilityConforms to UL94V-0 Lead Frame Material

Body MaterialNovolac epoxy

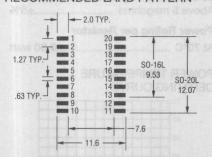
PACKAGE POWER TEMPERATURE DERATING CURVE



Package Power Rating at 70°C

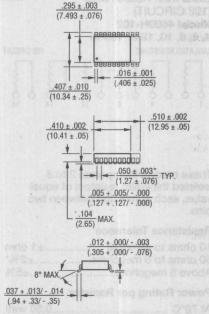
4420P2.00) watts
4416P1.60) watts

RECOMMENDED LAND PATTERN



NOTE: Land pattern dimensions are based on design rules established by the Institute for Interconnecting and Packaging Electronic Circuits in IPC-SM-782.

4420P



Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

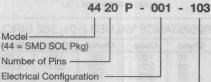
*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

TYPICAL PART MARKING

Represents total content. Layout may vary.



HOW TO ORDER



• 001/004 = Isolated* • 002 = Bussed*

• 002 = Bussed* • 003 = Dual Terminator*

Resistance Code

First 2 digits are significant

Third digit represents the number of zeros to follow.

*For tube packaging, use T01, T02, T03 or T04. Consult factory for other available options.

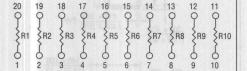
Specifications are subject to change without notice.

- Standard electrical shematics: isolated, bussed, dual terminator
- Custom circuits are available

Model 4400P

B[®] Resistor Networks

ISOLATED RESISTORS (001 and 004 CIRCUITS) Model 4416P-001 Model 4420P-001 (Shown)



Model 4416P-004 Model 4420P-004 (Shown)

PR10 9	18 1/ R9 J	16 15 R8 9	LR7 9	12 11 R6 9
SRIT ,	R2 3	FR37	7 R4 7	R5 10

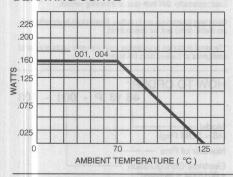
Resistance Tolerance

10 ohms to	49 ohms±1	ohm
50 ohms to	2.2 megohms	±2%*

Power Rating per Resistor

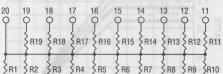
001 Circuit at 70°C	0.160 watt
004 Circuit at 70°C	0.160 watt

RESISTOR POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (002 CIRCUIT) Model 4416P-002

Model 4420P-002 (Shown)



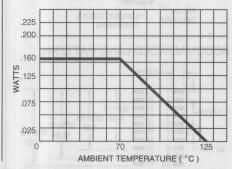
Resistance Tolerance

10	ohms	to	49 ohms±1	ohm
50	ohms	to	2.2 megohms	±2%*

Power Rating per Resistor

002 Circuit at 70°C0.160 watt

RESISTOR POWER TEMPERATURE **DERATING CURVE**

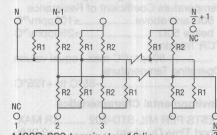


RESISTANCE VALUES (001, 004, and 002 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120.000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27,000	273	270,000	274
47	470	470	471	3,900	392	33.000	333	330,000	334
56	560	560	561	4,700	472	39,000	393	390,000	394
68	680	680	681	5,600	562	47.000	473	470,000	474
82	820	820	821	6,800	682	56,000	563	560,000	564
100	101	1,000	102	8,200	822	68,000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1.000,000	105

^{* ±1%} Tolerance is available by adding suffix code "F" after the resistance code.

DUAL TERMINATOR (003 CIRCUIT) Model 4416P-003 Model 4420P-003 (Shown)



4420P-003 terminates 16 lines, convenient for a 16-bit computer bus.

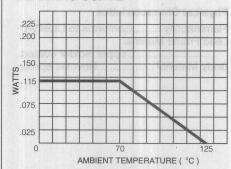
Resistance Tolerance

Below 100 ohms±2	ohms
100 ohms to 2.2 megohms	.±2%*

Power Rating per Resistor

003 Circuit at 70°C0.115 watt

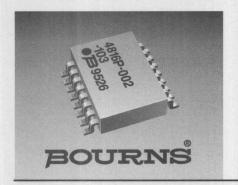
RESISTOR POWER TEMPERATURE **DERATING CURVE**



RESISTANCE VALUES (003 CIRCUIT)**

Resistance					
(01	nms)	Co	de		
R ₁	R ₂	R ₁	R ₂		
160	240	161	241		
180	390	181	391		
220	270	221	271		
220	330	221	331		
330	390	331	391		
330	470	331	471		
3,000	6,200	302	622		

^{**}Non-standard values available, within resistance range.



THICK FILM SURFACE MOUNTED MEDIUM BODY (5.59MM) SOM PACKAGE / 14, 16, 18 AND 20 PINS

- Standard E.I.A. package compatible with automatic placement equipment
- Tape and reel packaging standard (see page 114 for dimensions)
- For ordering guidelines, see page 114
- Marking on contrasting background for permanent identification

Model 4800P

B[®] Resistor Networks

Electrical Characteristics

Resistance Range
10 ohms to 2.2 megohms
Maximum Operating Voltage50V
Temperature Coefficient of Resistance
50Ω and above±100ppm/°C
below 50Ω±250ppm/°C
TCR Tracking
50ppm/°C max.; equal values
Operating Temperature
55°C to +125°C

Environmental Characteristics

120101211112012	
Short Time Overload	±0.25%
Load Life	±1.00%
Mechanical Shock	±0.25%
Moisture Resistance	±0.50%
Resistance to Soldering He	eat
	±0.25%
Thermal Shock	±0.25%
Insulation Resistance	

TESTS PER MIL-STD-202AR MAX.

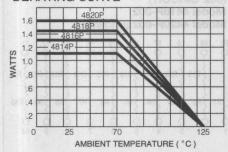
.....10,000 megohms min. Dielectric Withstanding Voltage200 VRMS Lead Solderability

.....Meet requirements of MIL-STD-202 Method 208

Physical Characteristics

Flammability	Conforms to UL94V-0
Lead Frame Mate	
	.Copper, solder coated
Rady Material	Novolco opovo

PACKAGE POWER TEMPERATURE **DERATING CURVE**

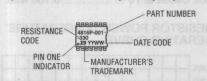


Package Power Rating at 70°C

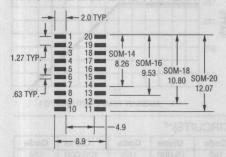
4814P	1.12	watts
4816P	1.28	watts
4818P	1.44	watts
4820P	1.60	watts

TYPICAL PART MARKING

Represents total content. Layout may vary.

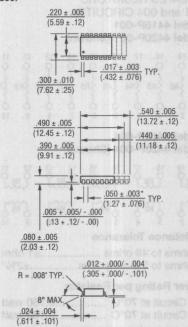


RECOMMENDED LAND PATTERN



NOTE: Land pattern dimensions are based on design rules established by the Institute for Interconnecting and Packaging Electronic Circuits in IPC-SM-782.

4800P

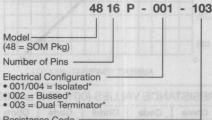


Lead coplanarity .004 inch max. at mounting surface.

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER



Resistance Code

• First 2 digits are significant Third digit represents the number of zeros to follow.

*For tube packaging, use T01, T02, T03 or T04. Consult factory for other available options.

- Compliant leads to reduce solder joint fatiguing
- Standard electrical schematics: isolated, bussed, dual terminator
- Custom circuits are available

Model 4800P

B[®] Resistor Networks

ISOLATED RESISTORS (001 and 004 CIRCUITS) Model 4814P-001 Model 4816P-001 (Shown) Model 4818P-001 Model 4820P-001 16 15 14 R3 R4 R5 R6 3R2 SR7 \$ R8 0 0 Model 4816P-004 (Shown)

Model 4820P-004

LR8 J	LR7J	LR6 J	LR5 J
SR1 3	SR2	FR3 7	FR4 3

16 15 14 13 12 11 10 9

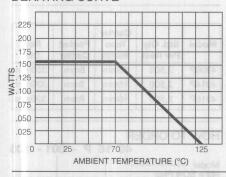
Resistance Tolerance

10	ohms	to	49 ohms±1 c	hm
50	ohms	to	2.2 megohms±2	2%*

Power Rating per Resistor

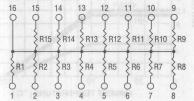
001 Circuit at 70°C0.160 watt 004 Circuit at 70°C0.160 watt

RESISTOR POWER TEMPERATURE **DERATING CURVE**



BUSSED RESISTORS

(002 CIRCUIT) Model 4814P-002 Model 4816P-002 (Shown) Model 4818P-002 Model 4820P-002 16 15 14 13



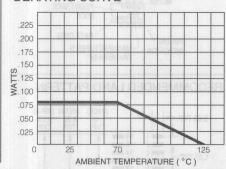
Resistance Tolerance

10 ohms to	49 ohms±	1 ohm
50 ohms to	2.2 megohms	.±2%*

Power Rating per Resistor

002 Circuit at 70°C0.080 watt

RESISTOR POWER TEMPERATURE **DERATING CURVE**



RESISTANCE VALUES (001, 004, and 002 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code	Ohms	Code
10	100	180	181	1,800	182	15,000	153	120,000	124
22	220	220	221	2,000	202	18,000	183	150,000	154
27	270	270	271	2,200	222	20,000	203	180,000	184
33	330	330	331	2,700	272	22,000	223	220,000	224
39	390	390	391	3,300	332	27.000	273	270,000	274
47	470	470	471	3,900	392	33,000	333	330,000	334
56	560	560	561	4,700	472	39.000	393	390,000	394
68	680	680	681	5.600	562	47.000	473	470,000	474
82	820	820	821	6.800	682	56.000	563	560,000	564
100	101	1,000	102	8,200	822	68.000	683	680,000	684
120	121	1,200	122	10,000	103	82,000	823	820,000	824
150	151	1,500	152	12,000	123	100,000	104	1,000,000	105

^{* ±1%} Tolerance is available by adding suffix code "F" after the resistance code.

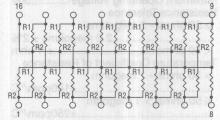
Specifications are subject to change without notice.

DUAL TERMINATOR (003 CIRCUIT)

Model 4814P-003 Model 4816P-003 (Shown)

Model 4818P-003

Model 4820P-003



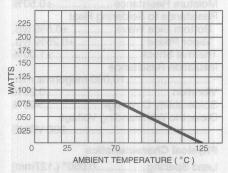
Resistance Tolerance

Below 100 ohms	±2	ohms
100 ohms to 2.2 mega	ohms	+2%*

Power Rating per Resistor

003 Circuit at 70°C0.080 watt

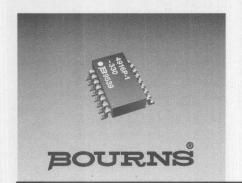
RESISTOR POWER TEMPERATURE **DERATING CURVE**



RESISTANCE VALUES (003 CIRCUIT)**

Resistance						
(OI	nms)	Co	de			
R ₁	R ₂	R ₁	R ₂			
160	240	161	241			
180	390	181	391			
220	270	221	271			
220	330	221	331			
330	390	331	391			
330	470	331	471			
3,000	6,200	302	622			

^{**}Non-standard values available, within resistance range.



THICK FILM SURFACE MOUNTED NARROW BODY (3.9MM) SON PACKAGE / 8, 14 AND 16 PINS

- Reduced board real estate requirements
- Compatible with automatic placement equipment
- Tape and reel packaging standard
- Compliant copper leads

Model 4900P

▶® Resistor Networks

Electrical Characteristics

Temperature Coefficient of Resistance > 50 ohms - 1 megohm±100ppm/°C

550 ohms, > 1 megohm ±250ppm/°C Voltage Coefficient

> 1K ohms±100ppm/°C typ. TCR Tracking (equal values)±50ppm/°C

Operating Temperature-55°C - +125°C

Storage Temperature-65°C - +125°C

00 0 1120 0

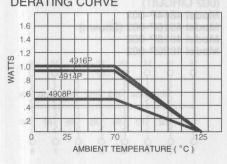
Environmental Characteristics

ΔR MAX.
±0.25%
1.00% typ.
±0.50%
±0.5% typ.
0.25% typ.
±1.00%
gohms min.
0.25%
>95%
ge
.200 VRMS

Physical Characteristics

Lead Spacing	0.050" (.127mm)
Lead Frame Materi	
	Copper, solder coated
Body Material	Novolac Epoxy

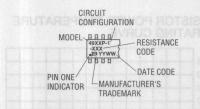
PACKAGE POWER TEMPERATURE DERATING CURVE



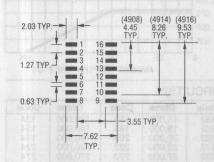
Package Power Rating	at 70°C
4908P	0.500 watts
4914P	0.875 watts
4916P	1.000 watts

Power Rating Per Resistor
001 Circuit at 70°C0.100 watts
002 Circuit at 70°C0.080 watts

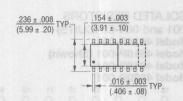
TYPICAL PART MARKING Represents total content. Layout may vary.

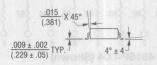


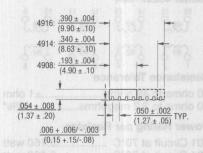
RECOMMENDED LAND PATTERN



NOTE: Land pattern dimensions are based on design rules established by the Institute for Interconnecting and Packaging Electronic Circuits in IPC-SM-782.



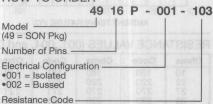




Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

Model	Std. Qty Per Reel	Carrier Tape Width	Pocket Center	Reel Dia.
4908P	2,500	12mm	8mm	330mm
4914P	2,500	16mm	8mm	330mm
4916P	2,500	16mm	8mm	330mm

HOW TO ORDER



First 2 digits are significant
Third digit represents the number of zeros to follow.

*For tube packaging, use T01, T02, T03 or T04.

SURFACE MOUNTED ORDERING GUIDE

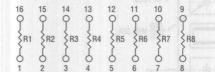
- Reduced assembly requirements vs. chip resistors
- Suitable for laptop computer and small hand-held devices
- Standard package and land pattern

Model 4900P

B[®] Resistor Networks

ISOLATED RESISTORS (001 CIRCUITS)

Model 4908P-001 Model 4914P-001 Model 4916P-001 (Shown)



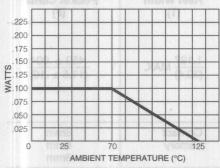
Resistance Tolerance

10	ohms	to	49 ohms±1 c	ohm
50	ohms	to	2.2 megohms±2	2%*

Power Rating per Resistor

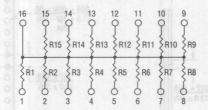
001 Circuit at 70°C0.100 watt

RESISTOR POWER TEMPERATURE DERATING CURVE



BUSSED RESISTORS (002 CIRCUITS)

Model 4908P-002 Model 4914P-002 Model 4916P-002 (Shown)



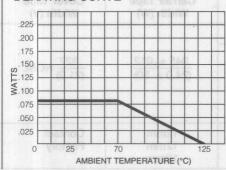
Resistance Tolerance

10	ohms	to	49 ohms±1	ohm
50	ohms	to	2.2 megohms	±2%*

Power Rating per Resistor

002 Circuit at 70°C0.080 watt

RESISTOR POWER TEMPERATURE DERATING CURVE



STANDARD RESISTANCE VALUES (001 AND 002 CIRCUITS)**

Ohms	Code	Ohms	Code	Ohms	Code
10	100	150	151	2,700	272
15	150	180	181	3,300	332
22	220	220	221	4,700	472
27	270	270	271	8,200	822
33	330	330	331	10,000	103
39	390	470	471	20,000	203
47	470	580	581	22,000	223
51	510	1,000	102	47,000	473
68	680	1,500	152	100,000	104
82	820	2,200	222	1,000,000	105
100	101				

^{*±1%} tolerance is available by adding suffix code "F" after the resistance code.

Specifications are subject to change without notice.

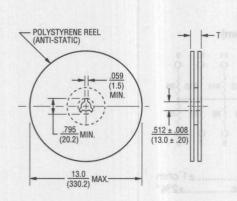
^{**}Non-standard values available, within resistance range.



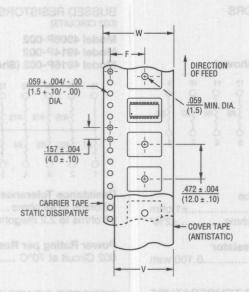
SURFACE MOUNTED ORDERING GUIDE

Electrical	*Circuit	Codes	educed assembly requirements vs. chip resistors	
Configuration	Tape & Reel	Tubes	Examples oned liams one resugmon got all not eldestice	
Isolated	001	T01	4816P-001-101 meltag brist bris agakbag brisbnat2 s	
Bussed	002	T02	Isolated Circuit in Tape & Reel Package	
Dual Terminated	003	T03	4816P-T01-101	
Adj. Isolated	004	T04	Isolated Circuit in Slide Tube Package	

^{*4816}P-XXX-RC: To specify package type, replace "XXX" with appropriate "Circuit Code".



NOTE: DIMENSIONS NOT SPECIFIED ARE PER EIA RS-481-2. DIMENSIONS ARE IN MILLIMETERS.



Model	Standard Quantity Per Reel	Carrier Tape Width (W)	Cover Tape Width (V)	Reel Width (T)	Pocket Center (F)
4416P	1,500				(-)
4420P	1,500	$ \begin{array}{c} .945 \pm .012 \\ \hline (24.0 \pm .30) \end{array} $	827	1 197	.453 ± .004
4814P 4816P 4818P 4820P	2,000		.827 (21.0) NOM.	1.197 (30.4) MAX.	(11.5 ± .10)
4908P 4914P 4916P	2,500	12mm 12mm 16mm	Contact Factory	Contact Factory	8mm 8mm 8mm

Leader Length = 500 min. Trailer Length = 500mm min. Empty Component Pockets Sealed with Cover Tape



THICK FILM SURGE RESISTOR NETWORK

- Lightning surge for standard waveforms
- Standard "off the shelf" design
- 1/2" (12.7mm) seated height
- Applications typically line card protection in telecom switching circuits and other high power applications
- Custom design available, contact factory

Model 4B04

B[®] Resistor Networks

Electrical Characteristics

Resistance Values	between 50 ohms
	and 100 ohms
Resistance Tolerance	±1%
TCR	100ppm/°C
Ratio Tolerance	±0.5%

Environmental Characteristics

TESTS PER MIL-STD-202ΔR	MAX
Resistance to Solvents	

......No Marking Deterioration Resistance to Solder Heat

±0.5% or 0.5 ohms, whichever is greater Solderability.....>95% Coverage

Insulation Resistance10 megohms minimum

(between isolated pins)
Bias Humidity Test.....50V/85% RH/85°C

Functional Characteristics

Lightning Surge Test	
Bellcore Spec TR-NWT-001089	
10 x 1000 μsec1	kV
2 x 10 μsec2.5	kV
IEC Spec 801-5	
10 x 700 μsec2	kV
Power Cross TestPer Bellcore sp	
(Vrms applied vary with resistan	
value	es)

Physical Characteristics

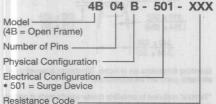
Body Style	.Open-Frame SIP
Body Material96%	Alumina Ceramic
Body Style	Open Frame SIP
Pin count	4

Part Numbers**

......4B04B-501-XXX

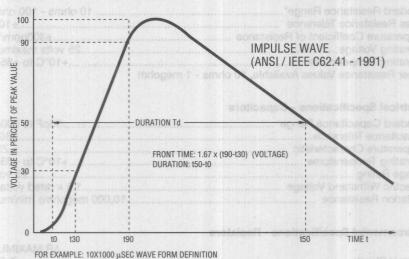
**XXX refers to the resistance code.

HOW TO ORDER



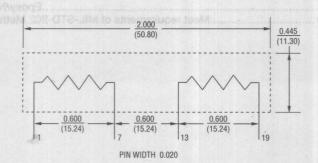
First 2 digits are significant
Third digit represents the number of zeros to follow

SURGE WAVEFORM DEFINITION



FOR EXAMPLE: 10X1000 µSEC WAVE FORM DEFINITION
OPEN-CIRCUIT VOLTAGE:
FRONT TIME: 10 µSEC
DURATION: 1000 µSEC

STANDARD SURGE NETWORK CONFIGURATION





RC NETWORKS T-FILTERS (EMI/RFI LOW PASS FILTERS)

General Description:

Continual advances in digital IC technology are creating stringent demands on EMI/RFI levels in equipment.

EMI/RFI low pass filters are required in personal computers, data terminals, test equipment and process controllers for high frequency suppression into or out of electronic equipment.

For additional information, see application note on pages 136 and 137.

601 Series

Bourns® EMI/RFI Filters

Electrical Specifications - Resistors

Standard Resistance Range*	10 ohms - 100 ohms
Series Resistance Tolerance	
Temperature Coefficient of Resistance	±300ppm/°C
Operating Voltage	
Operating Temperatures	+10°C to +85°C
*Other Resistance Values Available, 10 ohms - 1 meg	

Electrical Specifications - Capacitors

Standard Capacitance Range	50pF to 200pF
Capacitance Tolerance	
Temperature Characteristic	Z5U
Operating Temperatures	+10°C to +85°C
Voltage Rating	25 volts
Dielectric Withstand Voltage	1.5 x rated voltage
Insulation Resistance	10,000 megohms minimum

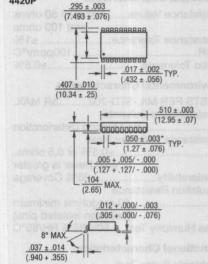
Environmental Specifications - Resistors

	∆R MAXIMUM
Thermal Shock	±0.5%
Resistance to Solder Heat	±0.5%
Terminal Strength	±0.5%

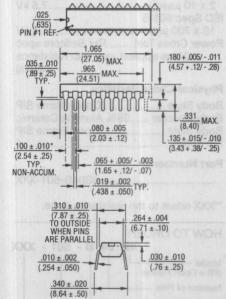
Mechanical Specifications

Flammability	Conforms to UL94 V-0
Leadframe	Copper, solder coated
Body Material	Epoxy/Novolac
	requirements of MIL-STD-202 Method 208

4420P



4118R AND 4120R



Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

These low-pass filters are ideal for installation between I/O drivers and RS 232 connectors.

Features:

- Cost effective R-C construction
- Insulation resistance testing for reliability
- Molded surface mount or DIP packaging
- Compatible with automatic assembly equipment
- Custom value capability

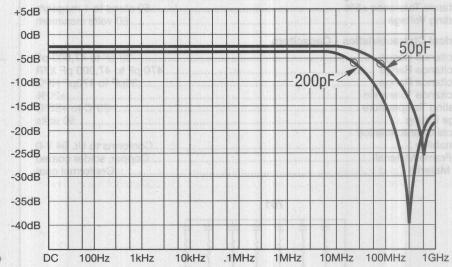
Model 601 Series

Bourns® EMI/RFI Filters

ATTENUATION VS. FREQUENCY - TYPICAL CAPACITOR VALUES WITH R = 25 OHMS

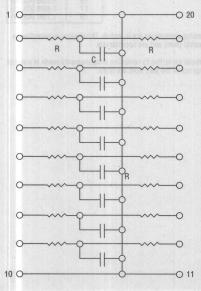
Attenuation vs. Frequency Model 4120R-601-250/500 Model 4420-601-250/500 50pF - 3dB @ 84 MHz

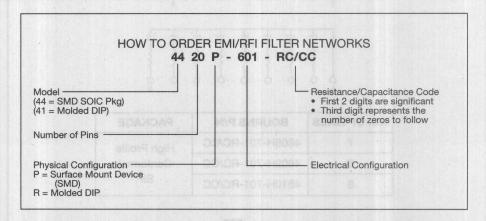
Attenuation vs. Frequency Model 4120R-601-250/201 Model 4420P-601-250/201 200pF - 3dB @ 21 MHz



O indicates - 3dB rollof frequency (fc)

TYPICAL CIRCUIT 4120R-601-RC/CC 4420R-601-RC/CC





Insert RC/CC Code from table below to form part number.

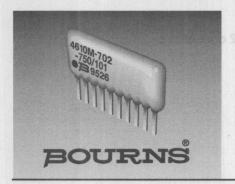
RC	R	CC	С
250	25Ω	500	50pF
270	27Ω	101	100pF
470	47Ω	181	180pF
820	82Ω	201	200pF
101	100Ω		0000

PACKAGES AVAILABLE

4420P-601-*RC/CC-SMD 4120R-601-*RC/CC-DIP 4118R-601-*RC/CC-DIP

*First two digits are significant. Third digit represents the number of zeros to follow.

Seven circuits in an 18-pin package. Eight circuits in a 20-pin package.



RESISTOR NETWORKS RC TERMINATOR NETWORKS

- Low noise termination for CMOS
- Combined resistors and capacitors in SIP package saves space
- Reduced insertion time
- Insulation resistance testing for reliability
- Pin counts from 4 to 16 available

For additional information, see application note on pages 138 and 139.

Model 700 Series

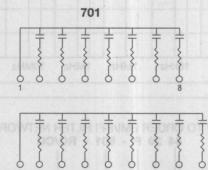
B[®] Resistor Networks

Electrical Characteristics - Resistors

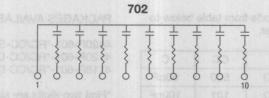
Standard Resistance Range	22 ohms to 500K ohms
Resistance Tolerance ±5%	50 ohms to 1 megohm
Operating Voltage	

Electrical Characteristics - Capacitors

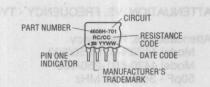
Capacitance Range	39 pF to 47,000 pF
	470 pF to 47,000 pF X7R
Capacitance Range	
	±20%
Operating Temperature	30°C to +85°C
Voltage Rating	50 volts
Physical Characteristics	
Flammability	Conforms to UL 94 V-0
Lead Frame Material	Copper, solder coated
Body Material	Conformal coat

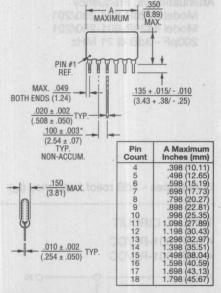


NO. OF LINES	BOURNS P/N	PACKAGE	
7	4608H-701-RC/CC	High Profile	
upma 8 support	4609H-701-RC/CC	Conformal	
9	4610H-701-RC/CC		



NO. OF LINES	BOURNS P/N	PACKAGE
outs in 8 n 18-pin Litte in a 20-pin c	4610H-702-RC/CC	High Profile Conformal SIP





Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

Advantages of RC Terminator Resistor Networks:

- Prevent bus lines and control signals from floating to undefined logic levels.
- Optimize signal transmission in high performance systems through proper termination.
- Eliminate overshoot and ringing, increase noise immunity, minimize signal distortion, and lower EMI/RFI radiation.
- Minimize space and routing problems, and reduce manufacturing cost per installed resistive function.
- Increase board yields and reliability by reducing component count.

Model 700 Series

B[®] Resistor Networks

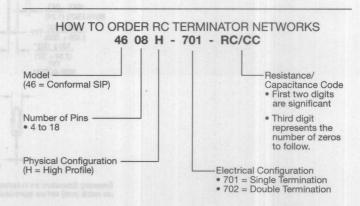
STANDARD RESISTANCE VALUES AND CODES

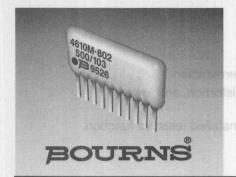
Resistance (Ohms)	Resistance Code	Resistance (Ohms)	Resistance Code
22	220	5,600	562
27	270	6,800	682
33	330	8,200	822
39	390	10,000	103
47	470	12,000	123
56	560	15,000	153
68	680	18,000	183
82	820	20,000	203
100	101 HA9	22,000	223
120	121 808	27,000	273
150	151	33,000	333
180	181	39,000	393
220	221	47,000	473
270	271	56,000	563
330	331	68,000	683
390	391	82,000	823
470	471	100,000	104
560	561	120,000	124
680	681	150,000	154
820	821	180,000	184
1,000	102	220,000	224
1,200	122	270,000	274
1,500	152	330,000	334
1,800	182	390,000	394
2,000	202	470,000	474
2,200	222	ETRAS	
2,700	272		185 - 1870, -1870
3,300	332		(c.ft = 200" = 05 y)
3,900	392		

Values not appearing in above tables are available to optimize system performance. Contact Bourns Networks to inquire.

STANDARD CAPACITANCE VALUES AND CODES

Capacitance	Capacitance Code	Capacitance	Capacitance Code
39pF	390	1000pF	102
47	470	1200	122
56	560	1500	152
68	680	1800	182
82	820	2200	222
100	101	2700	272
120	121	3300	332
150	151	3900	392
180	181	4700	472
220	221	5600	562
270	271	6800	682
330	331	8200	822
390	391	.010µF	103
470	471	.012	123
560	561	.015	153
680	681	.018	183
820	821	.022	223
		.027	273
IGH PROFILE		.033	333
		.039	393
		.047	473





RC NETWORKS ECL TERMINATOR CIRCUITS

Digital systems incorporating Emitter Coupled Logic (ECL) or other ultra-high switching speed logic families will require signal termination to prevent transmission line effects such as reflections and ringing due to fast transition times.

Bourns 800 series resistor capacitor networks are ideal for termination of high speed transmission lines. Each network is composed of resistors for parallel termination and bypass capacitor(s) for cross talk noise reduction.

The 5 conformal coated SIP circuit variations offered are as follows.

For additional information, see application note on pages 140 and 141.

Model 800 Series

B[®] Resistor Networks

Electrical Characteristics

Resistance Tolerance±5%
Resistance Power0.1 watt
Capacitance Tolerance±20%
Capacitor Dielectric TypeX7R
Capacitance Voltage Rating50 Volts

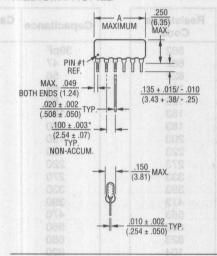
Physical Characteristics

Flammability	Conforms to UL94V-0
Leadframe	Copper (Olin 194)
Body Material	Epoxy/Anhydride
	(Conformal Material)

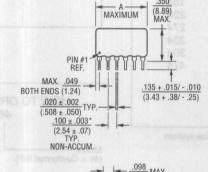
Custom Resistance Range10 ohms to 50K ohms Custom Capacitance Range39pF to 100,000pF

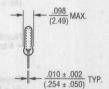
NPO and Z5U dielectrics available on a custom basis.

MEDIUM PROFILE



HIGH PROFILE



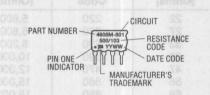


Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

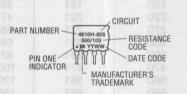
TYPICAL PART MARKING 801 AND 802

Represents total content. Layout may vary.



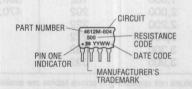
TYPICAL PART MARKING 803 AND 805

Represents total content. Layout may vary.



TYPICAL PART MARKING

Represents total content. Layout may vary.



- Optimize data transmission in ECL systems through proper termination between drivers and receivers
- Minimize overshoot, undershoot, and ringing while increasing noise immunity
- Provide decoupling capacitors
- Minimize space and routing problems, and reduce manufacturing cost per installed resistive function
- Increase board yields and reliability by reducing component count

Model 800 Series

≥® Resistor Networks

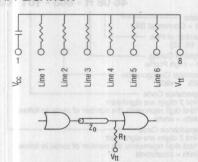
801 8, 10 AND 12 PIN SIP (4608M-801-RC/CC)

Designed to terminate 6 to 10 transmission lines using parallel termination techniques. Standard resistance values include 50, 68, 75, 82, 90 or 100 ohms and are chosen to match the characteristic impedance (Z_0) of the transmission line. A 0.01 mF capacitor is provided to help maintain a solid power supply level within the network package, mitigating any cross talk or feedthrough effects. Values for R and C not shown in the following table are available on a custom basis.

STANDARD 801 PART NUMBERS

R ±2%	C ±20%	Bourns Part Number
50Ω	0.01μF	4608M-801-500/103
68Ω	0.01µF	4608M-801-680/103
75Ω	0.01µF	4608M-801-750/103
82Ω	0.01µF	4608M-801-820/103
90Ω	0.01µF	4608M-801-900/103
100Ω	0.01µF	4608M-801-101/103

801 ELECTRICAL SCHEMATIC AND APPLICATION



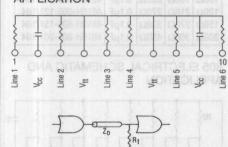
802 10 PIN SIP (4610M-802-RC/CC)

Designed to terminate 6 transmission lines using parallel termination techniques. Popular resistance values include 50, 68, 75, 82, 90 or 100 ohms and are chosen to match the characteristic impedance (Z_0) of the transmission line. Two 0.01 μ F capacitors are provided to reduce cross talk between lines and to decrease network package inductance. Values for R and C not shown in the following table are available on a custom basis.

STANDARD 802 PART NUMBERS

R ±2%	C ±20%	Bourns Part Number
50Ω	0.01µF	4610M-802-500/103
68Ω	0.01µF	4610M-802-680/103
75Ω	0.01µF	4610M-802-750/103
82Ω	0.01µF	4610M-802-820/103
90Ω	0.01µF	4610M-802-900/103
100Ω	0.01µF	4610M-802-101/103

802 ELECTRICAL SCHEMATIC AND APPLICATION



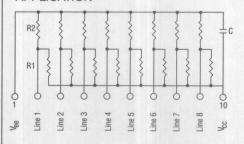
803 8, 10 AND 12 PIN SIP 10K ECL (4610H-803-ZoC/CC)

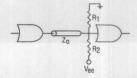
Designed to terminate 6 to 10 transmission lines using Thevenin equivalent parallel termination techniques in systems using 10K ECL. Popular impedance values include 50, 70, 75, 80, 90, 100, 120, 150 or 200 ohms. Standard values for R1 and R2, based on Zo, have been chosen to accommodate 10K ECL designs. A 0.1 µF capacitor is provided to reduce cross talk noise within the network package. Values for Zo and C not shown in the following table are available on a custom basis. This type of termination is an alternative to parallel termination used when a separate V_{tt} power supply is not available.

STANDARD 803 PART NUMBERS

Z0 ±2%	R1	R2	C ±20%	Bourns Part No.
50Ω	81Ω	130Ω	0.1µF	4610H-803-500/104
70Ω	113Ω	182Ω	0.1µF	4610H-803-700/104
75Ω	121Ω	195Ω	0.1µF	4610H-803-750/104
80Ω	130Ω	208Ω	0.1µF	4610H-803-800/104
90Ω	146Ω	234Ω	0.1µF	4610H-803-900/104
100Ω	162Ω	260Ω	0.1µF	4610H-803-101/104
120Ω	194Ω	312Ω	0.1µF	4610H-803-121/104
150Ω	243Ω	390Ω	0.1µF	4610H-803-151/104
200Ω	325Ω	520Ω	0.1µF	4610H-803-201/104

803 ELECTRICAL SCHEMATIC AND APPLICATION





Model 800 Series

B[®] Resistor Networks

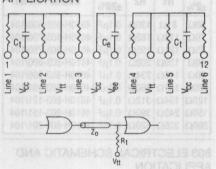
804 12 PIN SIP ECL (4612M-804-RC)

Designed to terminate 6 transmission lines using parallel termination techniques. Popular resistance values include 50 or 100 ohms. A 0.1 µF capacitor is provided for connection to V_{ee}. Two 0.01 μF capacitors are provided for connection to Vtt. Values for R and C not shown in the following table are available on a custom basis.

STANDARD 804 PART NUMBERS

R	Ct	Ce	Bourns Part Number
±2%	±20%	±20%	
50Ω 100Ω	p		4612M-804-500 4612M-804-101

804 ELECTRICAL SCHEMATIC AND **APPLICATION**



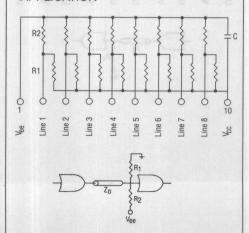
805 8, 10 AND 12 PIN SIP 100K ECL (4610H-805-ZoC/CC)

Designed to terminate 6 to 10 transmission lines using Thevenin equivalent parallel termination techniques in systems using 100K ECL. Popular impedance values include 50, 70, 75, 80, 90, 100, 120, 150 or 200 ohms. Standard values for R1 and R2, based on Z0, have been chosen to accommodate 100K ECL designs. A 0.1 μF capacitor is provided to reduce cross talk noise within the network package. Values for Zo and C not shown in the following table are available on a custom basis. This type of termination is an alternative to parallel termination used when a separate Vtt power supply is not available.

STANDARD 805 PART NUMBERS

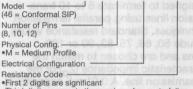
Zo ±2%	R1	R2	C ±20%	Bourns Part No.
50Ω	90Ω	113Ω	0.1μF	4610H-805-500/104
70Ω	126Ω	158Ω	0.1µF	4610H-805-700/104
75Ω	135Ω	169Ω	0.1µF	4610H-805-750/104
80Ω	144Ω	180Ω	0.1µF	4610H-805-800/104
90Ω	161Ω	202Ω	0.1µF	4610H-805-900/104
100Ω	180Ω	225Ω	0.1µF	4610H-805-101/104
120Ω	216Ω	270Ω	0.1µF	4610H-805-121/104
150Ω	270Ω	338Ω	0.1µF	4610H-805-151/104
200Ω	360Ω	450Ω	0.1µF	4610H-805-201/104

805 ELECTRICAL SCHEMATIC AND **APPLICATION**



HOW TO ORDER 801

46 08 M - 801 - 500 103



a Provide decoupling capacitors

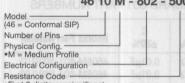
Third digit represents the number of zeros to follow.
 Units = ohms

- Capacitance Code ———
 First 2 digits are significant
- •Third digit represents the number of zeros to follow. •Units = picofarads

Consult factory for other available options.

HOW TO ORDER 802

46 10 M - 802 - 500 103

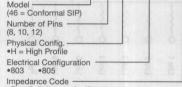


- First 2 digits are significant
 Third digit represents the number of zeros to follow. •Units = ohms
- Capacitance Code
- First 2 digits are significant
 Third digit represents the number of zeros to follow.
 Units = picofarads

Consult factory for other available options.

HOW TO ORDER 803 AND 805

46 08 H - 803 - 101 103



First 2 digits are significant

Third digit represents the number of zeros to follow.
Units = ohms

First 2 digits are significant

Third digit represents the number of zeros to follow.
 Units = picofarads

Consult factory for other available options.

HOW TO ORDER 804

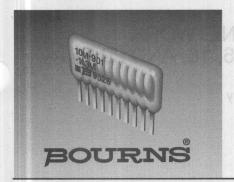
46 12 M - 804 - 500

(46 = Conformal SIP) Number of Pins Physical Config. ——
•M = Medium Profile **Electrical Configuration** Resistance Code

First 2 digits are significant
 Third digit represents the number of zeros to follow.

Consult factory for other available options.

Specifications are subject to change without notice.



CAPACITOR NETWORKS

- Integrates capacitor function in one package
- Design reduces termination noise
- Popular standard capacitance values available
- Isolated and bussed circuits available
- High temperature lead attachment to withstand reflow temperatures up to 260°C

Model 900 Series

B[®] Capacitor Networks

Electrical Characteristics

Capacitance Tolerance	
39 pF - 270 pF±1	0%
>270 pF - 0.1 μF±2	0%
Circuit ConfigurationIsolated & buss	sed
Capacitor DielectricNPO, >	(7R
Capacitance Voltage Rating	
39 pF - 270 pF	
NPO - 50V @ +25	5°C
>270 pF - 0.047 HF	

Physical Characteristics

Lead Spacing............0.050" (.127 mm) Lead Frame Material

.....X7R - 50V @ +25°C

.....Copper, solder coated Body Material

....Epoxy/Anhydride conformal material

Z5U dielectrics available on a custom basis.

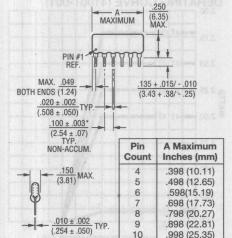
STANDARD HIGH VOLUME PART NUMBERS

4610M-901-103

4610M-902-103

4610M-901-104 4610M-902-104

MEDIUM PROFILE



11

12 13 1.098 (27.89)

1.198 (30.43)

1.298 (32.97)

TYPICAL PART MARKING PART NUMBER CIRCUIT CAPACITANCE CODE PIN ONE INDICATOR MANUFACTURER'S TRADEMARK

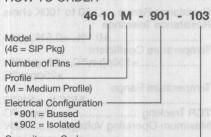
STANDARD CAPACITANCE VALUES AND CODES

These are the standard and non-standard capacitance values available. Consult factory for capacitance values and types outside this range. Tolerances of 5%, 10% and 20% are available.

"NPO" DIELECTRICS 10% Tolerance		"X7R" DIELECTRICS 20% Tolerance		"X7R" DIELECTRICS 20% Tolerance	
Capacitance (pF)	Capacitance Code	Capacitance (pF)	Capacitance Code	Capacitance (μF)	Capacitance Code
39 47 56 68 82 100 120 150 180 220 270	390 470 560 680 820 101 121 151 181 221 271	330 390 470 560 680 820 1000 1200 1500 1800 2200 2700 3300 3900 4700 5600 6800 8200	331 391 471 561 681 820 102 122 152 182 222 272 332 392 472 562 682 822	0.01 0.012 0.015 0.018 0.022 0.027 0.033 0.039 0.047 0.056* 0.068* 0.082* 0.1*	103 123 153 183 223 273 333 393 473 563 683 823 104

*25 volt rating
Specifications are subject to change without notice.

HOW TO ORDER



Capacitance Code

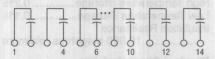
• First 2 digits are significant

 Third digit represents the number of zeros to follow

Consult factory for other available options.

ISOLATED CAPACITORS (902 CIRCUIT)

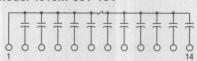
Model 4610M-902-103 Model 4610M-902-104



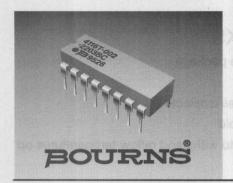
These models incorporate 2 to 7 isolated capacitors of equal value, each connected between two pins.

BUSSED CAPACITORS (901 CIRCUIT)

Model 4610M-901-103 Model 4610M-901-104



These models incorporate 3 to 13 capacitors of equal value, each connected between a common bus (Pin 1) and a separate pin.



THIN FILM RESISTOR NETWORK MOLDED DIP / 8, 14, 16, 18, AND 20 PIN

- Low noise characteristics
- Custom circuits available per factory

Model 4100T

B[®] Resistor Networks

Electrical Characteristics

Resistance Range50 to 100K ohms Resistance Tolerance

.....±0.1%, ±0.5%, ±1%

Temperature Coefficient

.....±100ppm/°C, ±50ppm/°C,

±25ppm/°C

Temperature Range

-55°C to +125°C TCR Tracking±5ppm/°C Maximum Operating Voltage.....50V

Environmental Characteristics

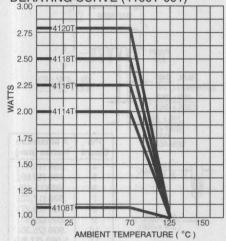
TESTS PER MIL-STD-202	AR MAX
Thermal Shock	0.1%
Low Temperature Operation	. 0.25%
Short Time Overload	0.1%
Resistance to Soldering Heat	0.1%
Moisture Resistance	0.1%
Mechanical Shock	. 0.25%
Life	0.5%
High Temperature Storage	0.2%
Low Temperature Storage	0.1%
Insulation Resistance	
10,000 megohms n	ninimum

Physical Characteristics

Lead Frame MaterialCopper, solder coated **Body Material Flammability**Conforms to UL94V-0

Body MaterialNovolac Epoxy

PACKAGE POWER TEMPERATURE DERATING CURVE (4100T-001)

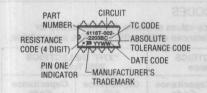


Package Power Ratings at 70°C

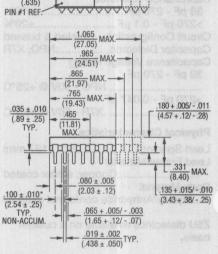
4108T	1.09 watts
4114T	2.00 watts
4116T	2.25 watts
4118T	2.50 watts
4120T	2.80 watts

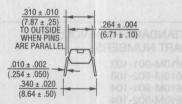
TYPICAL PART MARKING

Represents total content. Layout may vary.



(.635)

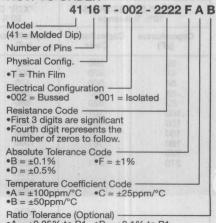




Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER



Ratio Tolerance (Optional) - $A = \pm 0.05\%$ to R1 $B = \pm 0.05\%$ to R1 •B = $\pm 0.1\%$ to R1

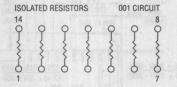
Consult factory for other available options.

Specifications are subject to change without notice.

Model 4100T

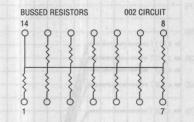
B[®] Resistor Networks

ISOLATED RESISTORS (001 CIRCUIT) Available in 8, 14, 16, 18, and 20 Pin



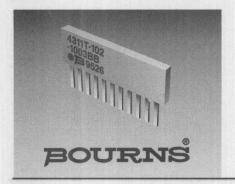
These models incorporate 4, 7, 8, 9, or 10 thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor......0.2 watt Resistance Range......50 to 100K ohms BUSSED RESISTORS (002 CIRCUIT) Available in 8, 14, 16, 18, and 20 Pin



These models incorporate 7, 13, 15, 17, or 19 thin-film resistors of equal value, each connected by a common pin.

Power Rating per Resistor......0.12 watt Resistance Range.......50 to 50K ohms



THIN FILM RESISTOR NETWORK MOLDED SIP/LOW, MEDIUM AND HIGH PROFILE, 6, 8, 9, 10, AND 11 PIN

- Low profile provides compatibility with DIPs
- Also available in medium profile (4300S) and high profile (4300K)
- Marking on contrasting background
- Custom circuits available per factory

Model 4300T, S, K Series

B[®] Resistor Networks

Electrical Characteristics

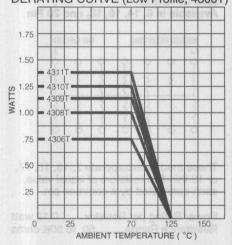
Resistance Range	
Bussed49.9 to 100K ohms	S
Isolated20 to 200K ohms	S
Series20 to 100K ohms	S
Resistance Tolerance	
±0.1%, ±0.5%, ±1%	6
Temperature Coefficient	
±100ppm/°C, ±50ppm/°C	
±25ppm/°C	5
Temperature Range	
55°C to +125°C	3
TCR Tracking±5ppm/°C	5
Maximum Operating Voltage50\	

Environmental Characteristics

Physical Characteristics

Body Material Flammability
......Conforms to UL94V-0
Lead Frame Material
.....Copper, solder coated
Body Material
.....Novolac epoxy

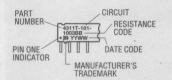
PACKAGE POWER TEMPERATURE DERATING CURVE (Low Profile, 4300T)

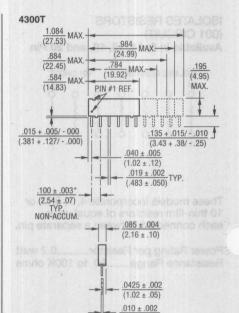


Package Power Ratings at 70°C

Т	S	K
4304	. 0.60	0.80 watts
4306 0.75	0.90	1.20 watts
4308 1.00	. 1.20	1.60 watts
4309 1.13		watts
4310 1.25	. 1.50	2.00 watts
4311 1.38		watts

TYPICAL PART MARKING Represents total content. Layout may vary.



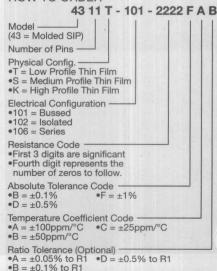


Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

(.254 ± .050)

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER



Consult factory for other available options.

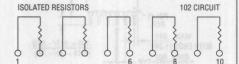
Specifications are subject to change without notice.

THIN FILM RESISTOR NETWORK CONFORMAL SIP/LOW, MEDIUM AND HIGH PROFILE, 4 THROUGH 16 PIN IN LOW profile providing companiality with DIPs

Model 4300T, S, K Series

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT) Available in 6, 8, 10 Pin



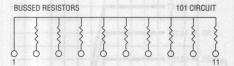
These models incorporate 3, 4, or 5 isolated thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor

- 0 10 000	0.18 watt
3	0.20 watt
K	0.25 watt
Resistance Range	20 to 200K ohms

BUSSED RESISTORS (101 CIRCUIT)

Available in 6, 8, 9, 10, 11 Pin

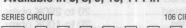


These models incorporate 5, 7, 8, 9, or 10 thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor

Т	0.10 watt
S	
K	0.15 watt
Resistance Range49.9	to 100K ohms

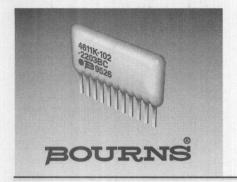
SERIES CIRCUIT (106 CIRCUIT) Available in 6, 8, 9, 10, 11 Pin



These models incorporate 5, 7, 8, 9, or 10 thin-film resistors of equal value, each connected in a series.

Power Rating per Resistor

T	watt
S	watt
K0.15	watt
Resistance Range20 to 100K of	hms



THIN FILM RESISTOR NETWORK CONFORMAL SIP/LOW, MEDIUM AND HIGH PROFILE, 4 THROUGH 16 PIN

- Low profile provides compatibility with DIPs
- Also available in medium profile (4600S) and high profile (4600K)
- Marking on contrasting background
- Custom circuits available per factory

Model 4600T, S, K Series

B[®] Resistor Networks

Electrical Characteristics

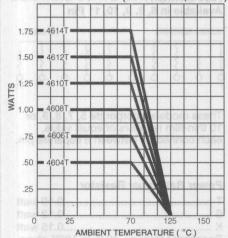
Environmental Characteristics

Environmental Characteristi	US
TESTS PER MIL-STD-202 Thermal Shock and	
Power Conditioning	
Low Temperature Operation	
Short Time Overload	
Terminal Strength	
Resistance to Soldering Heat.	0.1%
Moisture Resistance	0.1%
Mechanical Shock	0.25%
Vibration	0.25%
Life	0.5%
High Temperature Exposure	0.2%
Low Temperature Storage Insulation Resistance	0.1%
10,000 megohms	s minimum

Physical Characteristics

Body Material FlammabilityConforms to UL94V-0 Body Material.....Epoxy resin

PACKAGE POWER TEMPERATURE

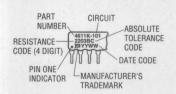


Package Power Ratings at 70°C

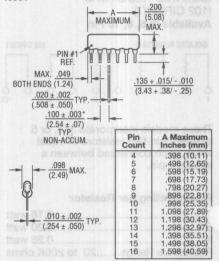
T	S	K
4604 0.50	0.60	0.8 watts
4605 0.63	0.75	1.0 watts
4606 0.75	0.90	1.2 watts
4607 0.88	1.05	1.4 watts
4608 1.00	1.20	1.6 watts
4609 1.13	1.35	1.8 watts
4610 1.25	1.50	2.0 watts
4611 1.38	1.65	2.2 watts
4612 1.50	1.80	2.4 watts
4613 1.63	1.95	2.6 watts
4614 1.75	2.10	2.8 watts
4615	2.18	3.0 watts
4616	2.26	3.2 watts

TYPICAL PART MARKING

Represents total content. Layout may vary.



DERATING CURVE (Low Profile, 4600T)

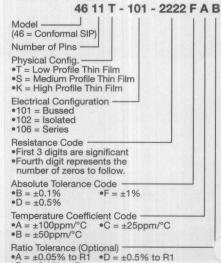


Maximum package length is equal to .100" (2.54mm) times the number of pins, less .002" (.005mm.)

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body

HOW TO ORDER



Consult factory for other available options.

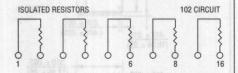
•B = ±0.1% to R1

Specifications are subject to change without notice.

Model 4600T, S, K Series

B[®] Resistor Networks

ISOLATED RESISTORS (102 CIRCUIT) Available in 4, 6, 8, 10, 12, 14, 16 Pin



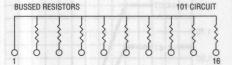
These models incorporate 2 to 8 isolated thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor

T	0.18 watt
S	0.20 watt
K	0.25 watt
Resistance Range	20 to 200K ohms

BUSSED RESISTORS (101 CIRCUIT) (101 CIRCUIT)

Available in 4 through 16 Pin

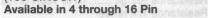


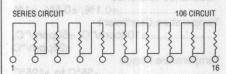
These models incorporate 3 to 15 thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor

Т	0.10 watt
S	0.12 watt
K	
Resistance Range49.9	to 100K ohms

SERIES CIRCUIT (106 CIRCUIT)



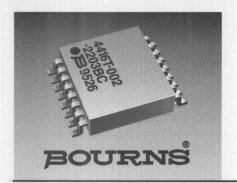


These models incorporate 3 to 15 thin-film resistors of equal value, each connected in a series.

SESTS PER MIL-STD-202AR MAN

Power Rating per Resistor

T	0.10 watt
S	0.12 watt
K	0.15 watt
Resistance Range20	to 100K ohms



THIN FILM RESISTOR NETWORK SOL WIDE BODY GULL WING/ 16 AND 20 PIN

- Increased lead density
- Custom circuits available per factory

Model 4400T

B[®] Resistor Networks

Electrical Characteristics

Resistance Range10 to 150K ohms Resistance Tolerance

.....±0.1%, ±0.5%, ±1% Temperature Coefficient

.....±100ppm/°C, ±50ppm/°C, ±25ppm/°C

Temperature Range

.....55°C to +125°C
TCR Tracking±5ppm/°C
Maximum Operating Voltage50V

Environmental Characteristics

TESTS PER MIL-STD-202∆R MAX
Thermal Shock 0.1%
Low Temperature Operation 0.25%
Short Time Overload 0.1%
Resistance to Soldering Heat 0.1%
Moisture Resistance 0.5%
Mechanical Shock 0.25%
Life 0.5%
Insulation Resistance

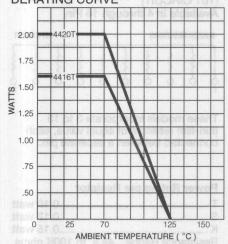
.....10,000 megohms minimum

Physical Characteristics

Lead Frame Material

.....Copper, solder coated Body Material Flammability

PACKAGE POWER TEMPERATURE DERATING CURVE

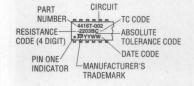


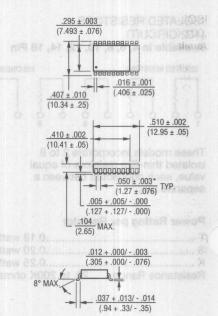
Package Power Ratings at 70°C

4416T1.60	watts
4420T2.00	watts

TYPICAL PART MARKING

Represents total content. Layout may vary.



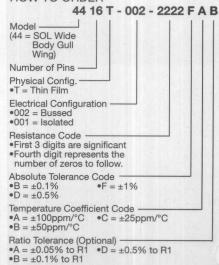


Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER

lodel 4600T, S, K Series



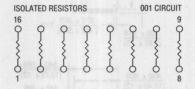
Consult factory for other available options.

THIN FILM RESISTOR NETWORK SOM MEDIUM BODY GULL WING 14, 16, 18, AND 20 PIN

Model 4400T

B[®] Resistor Networks

ISOLATED RESISTORS (001 CIRCUIT) Available in 16 and 20 Pin

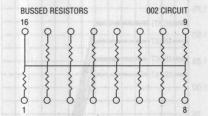


These models incorporate 8 or 10 thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor......0.15 watt Resistance Range......10 to 150K ohms

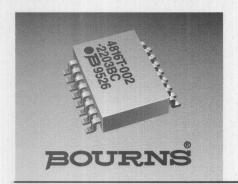
BUSSED RESISTORS (002 CIRCUIT)

Available in 16 and 20 Pin



These models incorporate 15 or 19 thin-film resistors of equal value, each connected by a common pin.

Power Rating per Resistor......0.10 watt Resistance Range.......10 to 75K ohms



THIN FILM RESISTOR NETWORK SOM MEDIUM BODY GULL WING/ 14, 16, 18, AND 20 PIN

- Increased lead density
- Custom circuits available per factory

Model 4800T

B[®] Resistor Networks

Electrical Characteristics

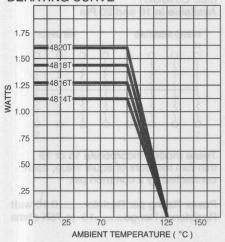
Resistance Range10 to 100K ohms
Resistance Tolerance±0.1%, ±0.5%, ±1%
Temperature Coefficient±100ppm/°C, ±50ppm/°C, ±25ppm/°C
TCR Tracking±5ppm/°C
Temperature Range±5°C to +125°C
Maximum Operating Voltage50V

Environmental Characteristics

TESTS PER MIL-STD-202AR MAX
Thermal Shock0.1%
Low Temperature Operation 0.25%
Short Time Overload0.1%
Resistance to Soldering Heat0.1%
Moisture Resistance0.1%
Mechanical Shock 0.25%
Life 0.5%
Insulation Resistance
10,000 megohms minimum

Physical Characteristics

PACKAGE POWER TEMPERATURE DERATING CURVE

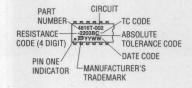


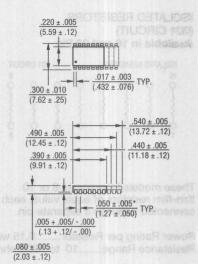
Package Power Ratings at 70°C

4814T	1.12 watts
4816T	1.28 watts
4818T	1.44 watts
4820T	1.60 watts

TYPICAL PART MARKING

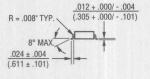
Represents total content. Layout may vary.





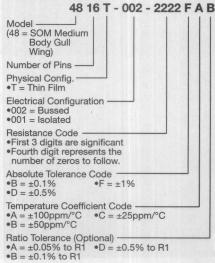
TOOMA IsboM

Resistor Networks



Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

HOW TO ORDER

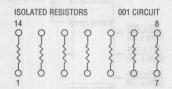


Consult factory for other available options.

Model 4800T

B[®] Resistor Networks

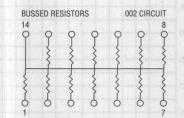
ISOLATED RESISTORS (001 CIRCUIT) Available in 14, 16, 18, and 20 Pin



These models incorporate 7, 8, 9, or 10 thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor......0.10 watt Resistance Range10 to 100K ohms BUSSED RESISTORS (002 CIRCUIT)

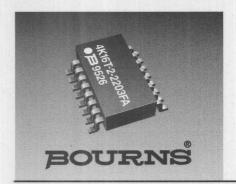
Available in 14, 16, 18, and 20 Pin



These models incorporate 13, 15, 17 or 19 thin-film resistors of equal value, each connected by a common pin.

Power Rating per Resistor......0.08 watt Resistance Range10 to 50K ohms

Package Power Ratings at 7010



THIN FILM RESISTOR NETWORK SON NARROW BODY GULL WING/ 8, 14 AND 16 PIN

- Low noise characteristics
- Thin film precision
- JEDEC standard package for pick and place
- Custom circuits available per factory

Model 4K00T

≥® Resistor Networks

Electrical Characteristics

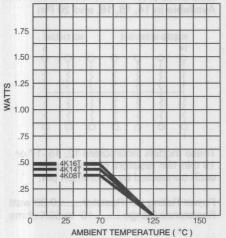
Resistance Range10 to 100K ohms Resistance Tolerance±0.1%, ±0.5%, ±1% Temperature Coefficient±100ppm/°C, ±50ppm/°C, ±25ppm/°C

Temperature Range-55°C to +125°C TCR Tracking±5ppm/°C Maximum Operating Voltage.....50V

Environmental Characteristics

IESIS	ΔR MAX.
Thermal Shock	0.1%
Physical Characteristics	
Lead Frame Material	
Copper, sold	er coated

PACKAGE POWER TEMPERATURE

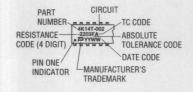


Package Power Ratings at 70°C

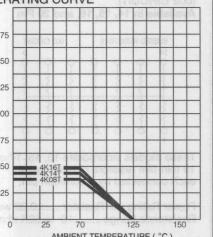
4K08T0.40	watts
4K14T0.45	watts
4K16T0.48	watts

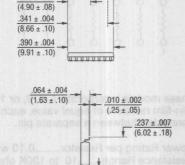
TYPICAL PART MARKING

Represents total content. Layout may vary.



DERATING CURVE





.....

Model 48001

.154 ± .004

(3.91 ± .10)

Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

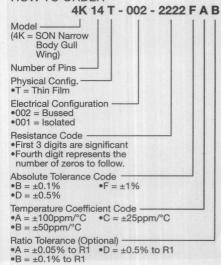
 $(.635 \pm .254)$

*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER

(1.27 ± .127)

.193 ± .003



Consult factory for other available options.

ENURUOE

EMI/IFI FILTERS 601 Series

stratets relating to noise frequencies

noise. By determining the cole of the

e! ni besseroxe ed nao concessed in !e

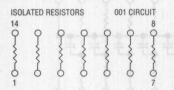
A final consideration is the insertion loss. As mentioned previously, the voltage drop across the two resistors will

SENSERAL DISCRIPTION
Continuel advences in digital IC technology are creating

Model 4K00T

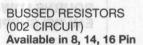
B[®] Resistor Networks

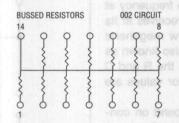
ISOLATED RESISTORS (001 CIRCUIT) Available in 8, 14, 16 Pin



These models incorporate 4, 7, or 8 thin-film resistors of equal value, each connected between a separate pin.

Power Rating per Resistor......0.10 watt Resistance Range......10 to 100K ohms





These models incorporate 7, 13 or 15 thin-film resistors of equal value, each connected by a common pin.

Power Rating per Resistor......0.08 watt Resistance Range.......10 to 30K ohms

PACKAGE		SOURNS	NO. OF LINES
		1118R-801-F	
9IQ		1120FR-601-F	
Ada Body SMD		14201-601-6	
		Я	
		я	
		R 28Ω	
	00 500 101	β 28Ω 27Ω	
	000 500 101	В 28Q 27Q 47Q	

R_S + R_L + 2R C(R + R_S(R + R_L)

that the additional RC time delay will not result in exceeding the sampling window of the inceiving IC, due to excessive tengthening of signal rise and fall times. First time from 10% to 90% of the waveform amplitude can be calculated in terms of the circuits RC time constant using the 1 $-\exp(-VRC)$ relationship for a charging capaciter. At 10%, $t_{\rm L}=0.1$ time constants and at 90%, $t_{\rm R}=2.3$

denominator of the transfer function agual to zero), the

time constants. "Time constant" equals $R_{\rm BL}C$, where $R_{\rm III}$ is the Travenin-equivalent resistance as seen by the capacitor. Therefore, equaling the difference in the two times to the maximum tolerable rice (or fall) times.

 $max = 2.2 \frac{(R + R_0)(R + R_1)C}{R_0 + R_1 + 2R}$



EMI/RFI FILTERS 601 Series

For product specifications, see pages 116 and 117.

GENERAL DESCRIPTION

Continual advances in digital IC technology are creating stringent demands on EMI/RFI levels in equipment.

EMI/RFI low pass filters are required in personal computers, data terminals, test equipment and process controllers for high frequency suppression into or out of electronic equipment.

FILTER SELECTION AND DESIGN CONSIDERATIONS

The "roll-off" frequency fc, defined as the frequency at which the filter passes one-half the power it receives at its input terminal, can be specified from the low megahertz range up to about 100MHz. This frequency, also known as the "-3 dB" frequency, will be determined by the R and C values chosen. Custom resistor and capacitor values are available to optimize system performance.

The specification of these values will depend on constraints relating to noise frequencies, system performance and driver loading. The following procedure is suggested to choose appropriate values of R and C.

The first step is to determine the desired roll-off frequency of the filter, which will lie between the signal frequency and the dominant frequencies of the EMI/RFI noise. By determining the pole of the filter (setting the denominator of the transfer function equal to zero), the roll-off frequency can be expressed in terms of R and C:

$$f_{C} = \frac{R_{S} + R_{L} + 2R}{2\pi C(R + R_{S})(R + R_{L})}$$

Furthermore, the RC combination must be chosen so that the additional RC time delay will not result in exceeding the sampling window of the receiving IC, due to excessive lengthening of signal rise and fall times.

Rise time from 10% to 90% of the waveform amplitude can be calculated in terms of the circuit's RC time constant using the 1 –exp (–t/RC) relationship for a charging capacitor. At 10%, $t_L=0.1$ time constants, and at 90%, $t_H=2.3$ time constants. "Time constant" equals R_{th} C, where R_{th} is the Thevenin-equivalent resistance as seen by the capacitor.

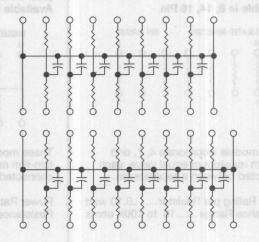
Therefore, equating the difference in the two times to the maximum tolerable rise (or fall) time:

$$t_{max} = t_H - t_L = 2.2R_{th}C$$

$$t_{max} = 2.2 \frac{(R + R_S)(R + R_L)C}{R_S + R_L + 2R}$$

A final consideration is the insertion loss. As mentioned previously, the voltage drop across the two resistors will attenuate the voltage reaching the load. Normally, logic high and low levels will still be within valid limits. The signal attenuation can be minimized by choosing small R values relative to the load impedance. Typical values for R range from 10 to 50 ohms.

BOURNS LOW-PASS FILTERS FOR EMI/RFI SUPPRESSION



NO. OF LINES	BOURNS P/N	PACKAGE
7	4118R-601-RC/CC	DID
8	4120R-601-RC/CC	DIP
8	4420P-601-RC/CC	Wide Body SMD

STANDARD RESISTANCE/CAPACITANCE VALUES AND CODES

RC	R	CC	C
250	25Ω	500	50pF
270	27Ω	101	100pF
470	47Ω	181	180pF
820	82Ω	201	200pF
101	100Ω	7.4 Table	

EMI/RFI FILTERS 601 Series

REDUCING EMI/RFI

The radiation of electromagnetic interference and radio frequency interference (EMI/RFI) to the environment is a pressing concern for many manufacturers of electronic equipment. According to FCC regulations (Parts 15 and 18), emissions must not exceed certain maximum levels depending on whether the equipment is for strictly industrial use or also for residential use. A graphical representation of these limits is shown in Figure 1. Similar restrictions apply to equipment sold in Europe (VDE 0871, a West German standard), Japan (VCCI), and to the military (MIL-STD-461/462.)

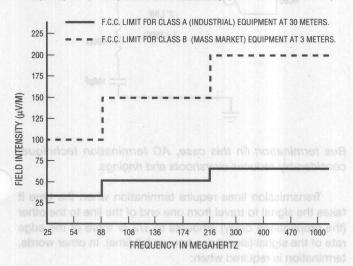


Figure 1. F.C.C. radiation limits for class A and class B computing devices

Several approaches are available today to control EMI/RFI emissions, including grounded metal enclosures, shielded cables, judicious component placement and interconnect designs, power-supply decoupling, and low-pass filtering of signal lines.

Low-pass filtering can be effective for EMI/RFI filtering when the noise components to be rejected occur at frequencies higher than the signal frequency (to be passed). For these situations, Bourns has developed low-pass resistor-capacitor filter networks which are ideal for boardlevel EMI/RFI filtering.

A typical application would be to filter signal lines between RS-232 drivers and their corresponding connectors. In such low to medium frequency applications, these networks represent a more useful (and economical) solution than inductive type filters such as ferrite beads. In fact, ferrite beads become mostly ineffective below 10MHz.

The basic "T" configuration (Figure 2) is a standard R-C network available in versions for 7 or 8 input lines. The 8 input-line version is available in both through-hole DIP and surface-mount models.

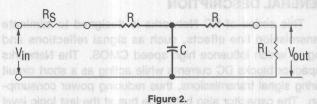


Figure 2. basic T-Filter configuration

Under steady state conditions, the capacitor C offers an infinite impedance to the DC component of the input waveform (which will be assumed for the moment to be entering from the left side). Thus, the DC component of the signal voltage is passed to the load, but reduced in value by the voltage drop across the two resistors.

The impedance of C becomes lower at higher (noise) frequencies. Thus, the noise component of the signal faces a voltage divider consisting of the first resistor (R) and C. At the high frequencies of the noise component, R will be much greater than the impedance of C, therefore, most of the noise voltage will be dropped across the resistor. Almost no noise current flows through the load and, therefore, will hardly affect the DC voltages (i.e., the signal) across the load.

Since the filter is symmetric, its principle of operation is the same for waveforms traveling in the opposite direction, in which case the voltage divider is formed by the second resistor and the capacitor. Such a symmetrical design is useful for filtering signals on a bidirectional bus.

Assuming purely resistive source and load impe-dances, the transfer function is given by:

$$\frac{\text{Vout}}{\text{Vin}} = \frac{\text{R}_{\text{L}}}{j\omega\text{C}(\text{R} + \text{R}_{\text{S}})(\text{R} + \text{R}_{\text{L}}) + (\text{R}_{\text{S}} + \text{R}_{\text{L}} + 2\text{R})}$$



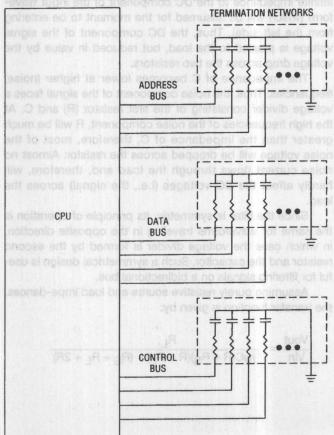
RC TERMINATOR NETWORKS 700 Series

For product specifications, see pages 118 and 119.

GENERAL DESCRIPTION

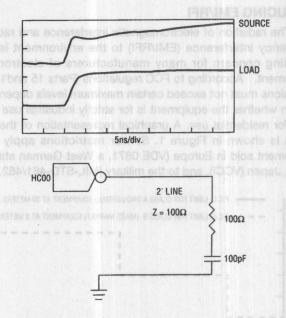
This series of RC Networks is designed to eliminate transmission line effects, such as signal reflections and ringing which influence high speed CMOS. The Networks capacitor blocks DC currents while acting as a short circuit during signal transmissions, thus reducing power consumption. The capacitor also holds the bus at the last logic level to avoid excessive currents.

BLOCK DIAGRAM OF CPU/BUS CONFIGURATION



BUS TERMINATION APPLICATIONS OF BOURNS NETWORKS

At high frequencies, the traces on a printed circuit board act as transmission lines—in which impedance mismatches can cause distortion of signals on that line. Terminating the lines with resistor or resistor-capacitor networks provides the means to match impedances and reduce signal distortion.



Bus termination (in this case, AC termination technique) considerably reduces overshoots and ringings.

Transmission lines require termination when the time it takes the signal to travel from one end of the line to the other (the propagation delay) amounts to 1/2 or more of the edge rate of the signal (signal rise time or fall time). In other words, termination is required when:

$$T_{pd}$$
 > (1/2)Te T_{e} = edge rate T_{pd} = propagation delay

Present high-speed logic families have typical rise times of 2 nanoseconds, while the propagation delay of a common PCB is about 1.77 ns per foot. Applying the above relationship, a transmission line will require termination if it is longer than 7 inches.

High performance systems will commonly need Bourns termination networks for CPU address, data, and control lines. In addition, clock inputs, write and read strobe lines, chip select or output enable lines of high speed devices such as static RAMs, PROMs, and PLDs will also need termination networks.

POWER USAGE	ADDS DELAY	VALUE	VALUE
orren en roted evitor	rs soon divineth	om aktober stati erfér t	nduscrin dan actis cos ds i
MEDIUM	NO	Zo	200-500pF
oth throug	i ni elda		nov anil-tuqi mase-samu
	MEDIUM	MEDIUM NO	MEDIUM NO Z _O

RC TERMINATOR NETWORKS 103 19 1000 83 17 MB 700 Series

For designers developing high performance systems, exact termination resistances which account for line loading may be desirable. This resistance (or equivalent resistance) can be calculated using the formula:

$$R_{\text{term}} = \frac{Z_0}{\sqrt{1 + C_d/C_0}}$$

where Z_{O} is the characteristic impedance of the line, C_{O} is the total capacitance associated with the receiving devices (typically 5 pF per input gate) or other loads off the line, and C_{O} is the intrinsic capacitance of the line.

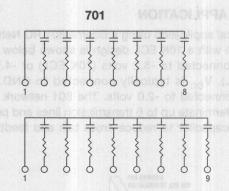
The series termination technique suppresses reflections at the driving device should any waveforms be reflected back from the driven end of the line. Series termination preserves power since there is no current path to ground or Vcc as in the other methods. However, this technique results in incident signals that transition slowly. It is also not appropriate for distributed loads due to the half-amplitude waveforms which exist at intermediate points along the line.

AC termination represents a compromise between power consumption and effect on performance. Its principle of operation is similar to parallel termination, but the capacitor blocks the DC component of the signal, thus reducing power consumption. However, the effectiveness of this method depends on the frequency and duty cycle of the application. AC termination also can be an expensive technique if implemented using discrete components rather than a network.

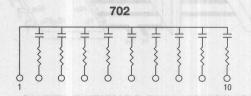
TYPICAL USAGE

While not every address, data and control line may require pull-up/pull-down or termination as part of the system's design, the table below shows common practice for some popular devices.

alphoted loads,	MICROPROCESSORS			MICRO- CONTROLLERS		
	68000	68020	80286	80386	68HC11	8051
No. address lines Termination	23	32 32	24	32 32	oneoilgo	10
No. data lines Termination	16 0	32 32	16 0	32 32	sa u anti a es griout	ong v
No. control lines Termination	21	27 27	13	15 15		
Total I/O lines Termination	60 0	91 91	53 0	79 79	38 0	32 0



NO. OF LINES	BOURNS P/N	PACKAGE
7	4608H-701-RC/CC	High Profile
8	4609H-701-RC/CC	Conformal
9	4610H-701-RC/CC	SIP



NO. OF LINES	BOURNS P/N	PACKAGE
priole 8 son	4610H-702-RC/CC	High Profile Conformal SIP

For all AC terminators, standard R values are 50, 68, 75 and 100 ohms. Standard values for C are 47, 100, 500 and 1000pF. See data sheet to select custom combinations of R and C.

REFERENCES:

- 1. Blood, W.R., MECL System Design Handbook, Motorola, Inc., 1983.
- 2. F100K ECL Data Book, Fairchild Semiconductor Corp., 1986.
- 3. MECL Device Data, Motorola, Inc., 1987.

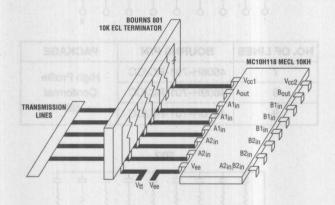


BOURNS EMITTER COUPLED LOGIC TERMINATOR 800 Series

For product specifications, see pages 120 and 122.

TYPICAL APPLICATION

A typical application using a Bourns 801 RC Network in conjunction with a 10K ECL design is shown below. Vee is typically connected to -5.2 volts (10K ECL) or -4.5 volts (100K ECL). V_{CC} is typically connected to GND. V_{tt} is typically connected to -2.0 volts. The 801 network shown below can terminate up to 6 transmission lines and provides a 0.01 µF capacitor to reduce cross talk and feedthrough effects.



TRANSMISSION LINE CONSIDERATIONS

In high speed circuit applications, the signal propagation delay (Tpd) and characteristic impedance (zo), along a printed circuit board line must be taken into consideration. In general, if the two-way delay along the line is greater than the rise or fall time of the signal, then controlled impedance techniques (i.e., termination) must be utilized to prevent undesirable ringing or over- and undershoots. The delay and impedance can be calculated by knowing the intrinsic inductance (Lo) and capacitance (Co) of the line:

$$T_{pd} = \sqrt{L_0 C_0}$$

$$Z_0 = \sqrt{L_0 / C_0}$$

The actual, effective delay and impedance due to loading from stubs or additional devices off the line will be:

$$T_{pd}' = T_{pd} \sqrt{1 + C_d/C_o}$$

$$Z_{o}' = \sqrt{\frac{Z_o}{1 + (C_d/C_o)}}$$

Where C_o = intrinsic capacitance of the line C_d = capacitance due to loading and stubs

> off the line T_{pd} = basic propagation delay of the line

Z_O = basic impedance of the line

To formulate a guideline for when line termination is necessary, take the ratio of the rise time or fall time and the two-way delay along the line. The maximum length for unterminated lines will result as follows:

$$L_{\text{max}} = \frac{T_{\text{r}}}{2T_{\text{pd}}}$$

Where $T_r = rise$ or fall time: rightarrow = rise or fall time: rightarrow = rise or fall time: rightarrow = riseT_{pd} = propagation delay per unit length

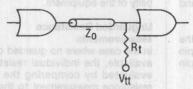
The above equation implies that the faster the edge rate or the higher the loading on the line (i.e., higher fanout), the more likely that termination will be necessary for a given line

PARALLEL TERMINATION

For maximum circuit performance or distributed loads, parallel termination is the most appropriate technique. A parallel terminated line uses a resistor connected to -2 volts (ECL application) at the receiving end. The resistor value matches the characteristic impedance of the line (Zo), thereby producing zero reflection at the receiver. In addition, the terminating resistor also provides output pull down, so a separate pull down resistor at the driving end is unnecessary.

BOURNS EMITTER COUPLED LOGIC TERMINATOR 800 Series

Bourns 801, 802, and 804 conformal coated SIP resistor capacitor networks are designed to terminate 6 transmission lines using the parallel termination technique. A 0.01 μF capacitor(s) is provided in each network to help maintain a solid Vtt level within the package, mitigating any potential cross talk or feedthrough effects. The 804 circuit also contains a 0.1 μF capacitor for bypassing the V_{ee} supply.



Parallel Termination Technique

THEVENIN EQUIVALENT PARALLEL TERMINATION

Parallel termination in ECL applications uses -2.0 volts as the terminating voltage. This represents a disadvantage since a separate V_{tt} power supply must be available (V_{ee} = -5.2 volts, V_{tt} = -2.0 volts). For systems in which a separate -2.0 volt supply is not available, the use of a Thevenin equivalent arrangement, although resulting in higher power consumption, provides a convenient solution.

Bourns 803 and 805 conformal coated SIP resistor capacitor networks are designed to terminate 8 transmission lines using the Thevenin equivalent parallel termination technique. Again, a 0.1 µF capacitor is provided to help maintain a solid Vee level within the package, mitigating any potential cross talk or feedthrough effects. The 803 is designed for use with 10K ECL whereas the 805 is designed for use with 10K ECL.

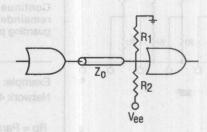
roted from any values of R1 and R2 for a Dust Terminator Networ

Utilization of these formulas will enable you to determine the equivalent uni-

 R_1 and R_2 are calculated using the following equations: $R_2 = (V_{ee}/V_{tt})^*Z_0$ $R_1 = (R_2^*V_{tt})/(V_{ee}-V_{tt})$

For a 10K ECL supply voltage of -5.2V and V_{tt} of -2V: $R_2 = 2.6*Z_0$ $R_1 = R_2/1.6$

For a 100K ECL supply voltage of -4.5V and V_{tt} of -2V: $R_2 = 2.25^*Z_0$ $R_1 = R_2/1.25$



Thevenin Equivalent Parallel Termination Technique

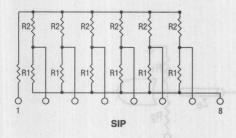
REFERENCES:

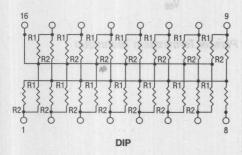
- Blood, W.R., MECL System Design Handbook, Motorola, Inc., 1983.
- F100K ECL Data Book, Fairchild Semiconductor Corp., 1986.
- 3. MECL Device Data, Motorola, Inc., 1987.
- 4. ECLinPS Data, Motorola, Inc., 1987.

DUAL TERMINATOR RESISTOR NETWORK

The Dual Terminator (or Thevenin equivalent) Network is commonly used for TTL dual-line termination and pulse squaring or ECL line terminations. In ECL line terminator, R2 functions as an emitter pull-down resistor and is normally tied to the most negative supply voltage to provide proper line currents. R1 is normally tied to ground and functions as the termination resistor and in parallel with R2 provides the characteristic impedance of the transmission line. This results in a zero reflection coefficient of this line to eliminate reflections.

The Dual Terminator circuit is available in both SIP and DIP configurations, as shown below.





Testing of Dual Terminators

Since the Dual Terminator circuit has many resistors in parallel, a direct pin-to-pin measurement for the values of R1 and R2 can be made using an ohmmeter with guard capabilities.

The function of the guard pin is to apply and equal voltage across the adjacent (parallel) resistance path. When applied, current flow is eliminated allowing an accurate measurement of the resistor under test.

Using the 8-pin SIP network shown, the testing method would be as follows:

Test R1 Values

To test the first resistor, connect the ohmmeter measurement leads between pin 8 and 2. Connect the guard lead to pin 1. R1 is now guarded and an accurate measurement can be made.

To test the second R1 resistor, connect the measurement leads between pin 8 and pin 3. Connect the guard to pin 1 and make the resistance measurement.

Continue this testing scheme for the remainder of the R1 resistors, always guarding pin 1.

Test R2 Values

To test the first R2 resistor, connect the ohmmeter measurement leads between pin 1 and pin 2. Connect the guard lead to pin 8. The first R2 resistor is now guarded and an accurate measurement can be made.

To test the second R2 resistor, connect the ohmmeter measurement leads between pin 1 and pin 3. Connect the guard lead to pin 8 and make the resistance measurement.

Continue this testing scheme for the remainder of the R2 resistors, always guarding pin 8.

An example of the type of ohmmeter to be utilized that incorporates a guarded measurement capability is the RACAL-DANA Model 6000 where the guard pin is the "analog low" lead. An additional ohmmeter is ESI Model 1700 where the guard pin is labeled "Guard." It must be noted that guarded measurements using ohmmeters of these types are satisfactory for measurements up to a ratio of about 10:1 between R1 and R2. Above a 10:1 ratio, accuracy is degraded and measurements can be incorrect because of inadequate guarding capability of the equipment.

Unguarded Resistance

Measurements

In the case where no guarded ohmmeter is available, the individual resistors can be evaluated by comparing the unguarded resistance measurement to the theoretical value of the equivalent series-parallel circuit and determining the percent of error of each resistor.

Example:

Network 4608X-104-221/331 where R1 values are 220W and R2 values are 330 Ω .

Rp = Parallel Resistance of Remaining Circuit (See diagram below.)

RE = Equivalent Series - Parallel Resistance Seen by Unguarded Meter

$$RE_{R1} = (P8-P2) = \frac{R1 (R2 + Rp)}{R1 + (R2 + Rp)} = \frac{220 (330 + 110)}{220 + (330 + 110)} = \frac{146.67\Omega}{2\% \text{ Tolerance}} \approx \pm 1.96\Omega^*$$

$$RE_{R2} = (P1-P2) = \frac{R1 (R2 + Rp)}{R1 + (R2 + RP)} = \frac{3300 (220 + 110)}{330 + (220 + 110)} = \frac{165\Omega}{2\% \text{ Tolerance}} \approx \pm 1.65\Omega^*$$

$$Rp = \frac{550}{5} = 110\Omega$$

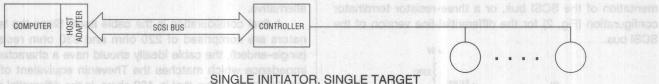
Utilization of these formulas will enable you to determine the equivalent unguarded resistance to be expected from any values of R1 and R2 for a Dual Terminator Network.

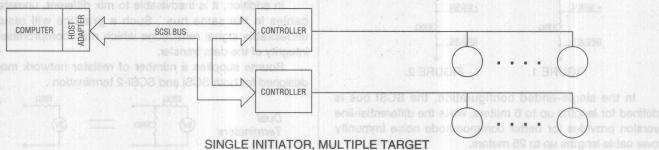
*2% tolerance
$$\approx \frac{(RE_{R1})^2}{R1}$$
 X .02 = 1.96 Ω

SCSI APPLICATIONS

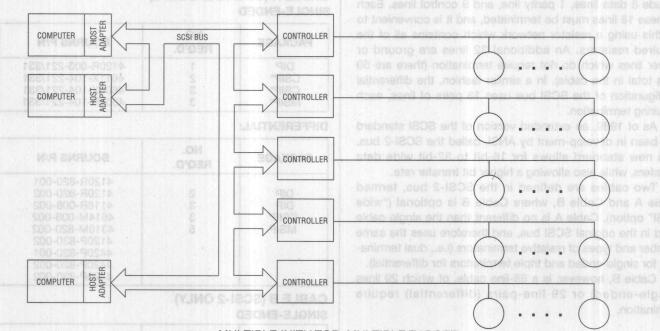
AMERICAN NATIONAL STANDARD X3 131-1986

Peripheral devices such as magnetic-disks, printers, optical-disks, and magnetic-tapes.





SINGLE INITIATOR, MULTIPLE TARGET



MULTIPLE INITIATOR, MULTIPLE TARGET **BLOCK DIAGRAM OF SCSI SYSTEM**

USE BOURNS NETWORKS TO:

- Provide the terminating resistors required for SCSI implementation.
- Optimize signal transmission by eliminating overshoot and ringing.
- Minimize space and routing problems, and reduce manufacturing cost per installed resistive function.
- Increase board yields and reliability by reducing component count.

TERMINATION OF THE SCSI BUS

The Small Computer System Interface follows American National Standard which provides the mechanical, electrical, and functional requirements for an input/output bus to connect small computers with a variety of peripheral devices. The most common application of this bus is to connect small computers with disk drive (mass storage) units.

The primary resistor network application in SCSI busses is line termination. The termination method is specified in ANSI X3.131-1986 as either a Thevenin equivalent dual

SCSI APPLICATIONS

terminator configuration (Fig. 1) for the single-ended implementation of the SCSI bus, or a three-resistor terminator configuration (Fig. 2) for the differential-line version of the SCSI bus.

$$\begin{array}{c} +5V \\ \hline & & \\ & &$$

In the single-ended configuration, the SCSI bus is defined for lengths up to 6 meters, while the differential-line version provides for better commonmode noise immunity over cable lengths up to 25 meters.

The signal assignments on the single-ended SCSI bus include 8 data lines, 1 parity line, and 9 control lines. Each of these 18 lines must be terminated, and it is convenient to do this using a resistor network which contains all of the required resistors. An additional 32 lines are ground or power lines which do not require termination (there are 50 lines total in the cable). In a similar fashion, the differential configuration of the SCSI bus uses 18 pairs of lines, each requiring termination.

As of 1989, an extended version of the SCSI standard has been in develop-ment by ANSI, called the SCSI-2 bus. This new standard allows for 16-bit to 32-bit wide data transfers, while also allowing a higher bit transfer rate.

Two cables are defined in the SCSI-2 bus, termed Cable A and Cable B, where Cable B is optional ("wide SCSI" option). Cable A is no different than the single cable used in the original SCSI bus, and therefore uses the same number and types of resistive terminators (i.e., dual terminators for single-ended and triple terminators for differential).

Cable B, however, is a 68-line cable, of which 29 lines (single-ended) or 29 line-pairs (differential) require termination.

APPLICATION GUIDELINES

The principles of transmission-line theory apply to SCSI terminators, and therefore for proper operation their placement must be restricted to the ends of the bus and nowhere else. This implies that the terminators should be placed as close to the SCSI devices as possible. It is permissible to place the terminator inside the SCSI device, but only if that device is located at the end of the bus.

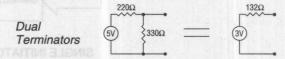
For disk drive applications, SCSI terminators must be present on the host adapter card and at the disk drive end as well. Many disk drive manufacturers have opted to design in removable SCSI terminators into their units to account for the possibility that their unit may not be the one at the end of the cable. For these manufacturers, the combination of a resistor network in a through-hole version

plus a matching socket represents the only (and expensive) alternative.

A final consideration is the cable itself. Since the terminators are comprised of 220 ohm and 330 ohm resistors (single-ended), the cable ideally should have a characteristic impedance which matches the Thevenin equivalent of this resistor combination, that is, 132 ohms. In the differential case, a characteristic impedance of 122 ohms would be ideal.

In addition, it is inadvisable to mix different, unmatched cables in the same bus. Such a practice will result in undesirable signal reflections which may compromise the integrity of the data transfer.

Bourns supplies a number of resistor network models designed for both SCSI and SCSI-2 termination .



CABLE A (SCSI AND SCSI-2) SINGLE-ENDED

PACKAGE	NO. REQ'D.	BOURNS P/N	
DIP	1	4120R-003-221/331	
CSIP*	2	4611X-104-221/331	
CSIP*	3	4608X-104-221/331	
MSIP*	3	4308R-104-221/331	

DIFFERENTIAL:

PACKAGE	NO. REQ'D.	BOURNS P/N	
		4120R-820-001	
DIP	2	4120R-820-002	
DIP	3	4116R-008-002	
CSIP*	3	4614M-008-002	
MSIP	5	4310M-820-002	
		4120P-830-002	
		4420P-820-001	
		4420P-820-002	
1/1		4420P-830-002	

CABLE B (SCSI-2 ONLY) SINGLE-ENDED

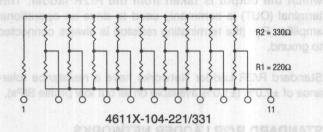
PACKAGE	NO. REQ'D.	BOURNS P/N
DIP	2	4118R-003-221/331
CSIP*	3	4612X-104-221/331
CSIP*	4	4610X-104-221/331
MSIP*	4 6 7 15	4310R-104-221/331

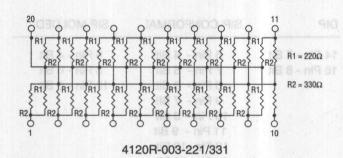
DIFFERENTIAL:

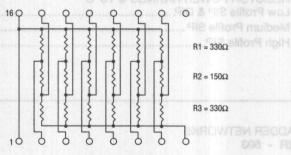
PACKAGE	NO. REQ'D.	BOURNS P/N	
DIP	mater 4 column	4118R-820-002	
DIP	5	4116R-008-002	
CSIP*	5	4614M-820-002	
MSIP*	8 6118	4310M-820-002	

*Medium Profile (.250" seated height) and high profile (.350" seated height) are available by placing the letter "M" or "H," respectively, in the fifth position of the part number.

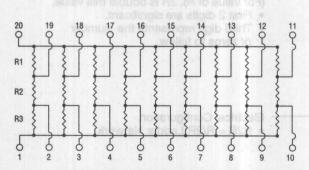
SCSI APPLICATIONS Representative Terminator Schematics







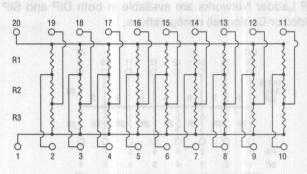
4116R-008-002



820 ELECTRICAL SCHEMATIC

4120R-820-001
4420P-820-001
$R1 = 270\Omega$
$R2 = 820\Omega$
R3 = 1800





830 ELECTRICAL SCHEMATIC

4120R-830-002 4420P-830-002 $R1 = 330\Omega$ $R2 = 150\Omega$ $R3 = 330\Omega$

ABBREVIATIONS

DIP = Dual In-Line Package

MSIP = Molded Single In-Line Package

CSIP = Conformal Coated Single In-Line Package

PCC = Plastic Chip Carrier

SOM = Small Outline Surface Mount Package, Medium Body (.220")

SOL = Small Outline Surface Mount Package,

Wide Body (.300")

SON = Small Outline Surface Mount Package,

Narrow Body (.154")

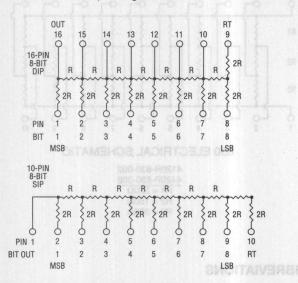
REFERENCES

- 1. "Small Computer System Interface", (ANSI X3.131-1986), American National Standards Institute Inc., 1986.
- 2. "Small Computer System Interface 2" (working draft proposal), Revision 5, American National Standards Institute Inc., August 9, 1988.
- 3. Standard Products Data Book, NCR Corporation, 1988.

*Medium Profile (.250" seated height) and high profile (.350" seated height) are available by placing the letter "M" or "H," respectively, in the fifth position of the part number.

R/2R LADDER NETWORKS

R/2R Ladder Networks are available in both DIP and SIP (Molded or Conformal) configurations.



The R/2R Ladder Network is commonly used for Digital to Analog (D/A) conversions and Analog to Digital (A/D) conversion by successive approximations. The bits of the ladder are the points at which input signals are presented to the ladder and the output terminal (OUT) is the point at

which the output is taken from the R/2R ladder. This terminal (OUT) is commonly used to drive an operational amplifier. R_{T} (the terminating resistor) is always connected to ground.

Standard R/2R Ladder Networks have a resistance tolerance of ±2.0% (±1.0% available on all but low profile SIPs).

STANDARD R/2R LADDER NETWORKS

Availability is as follows:

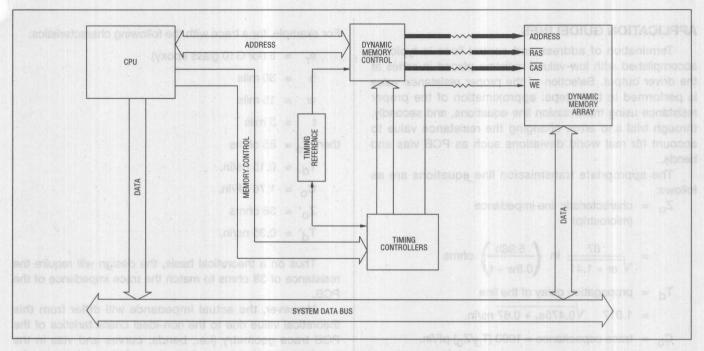
DIP	SIP-CONFORMAL	SIP MOLDED
14 Pin - 7 Bit	6 Pin - 4 Bit	6 Pin - 4 Bit
16 Pin - 8 Bit	7 Pin - 5 Bit	8 Pin - 6 Bit
	8 Pin - 6 Bit	10 Pin - 8 Bit
	9 Pin - 7 Bit	
1 -	10 Pin - 8 Bit	
	11 Pin - 9 Bit	
	12 Pin -10 Bit	
	14 Pin -12 Bit	

RESISTOR POWER RATINGS @ 70° C	
Low Profile SIP & DIP	125W
Medium Profile SIP	170W
High Profile SIP	200W

HOW TO ORDER R/2R LADDER NETWORKS 41 16 R - R2R - 503 Model Resistance/Capacitance Code (41 = Molded DIP) (For value of R). 2R is double this value. (43 = Molded SIP) First 2 digits are significant. (46 = Conformal SIP) Third digit represents the number (48 = Medium Body SOIC) of zeros to follow. Number of Pins -Physical Configuration -**Electrical Configuration** (R = Low Profile - Molded) • R2R = R/2R Ladder Network (X = Low Profile - Conformal) (M = Medium Profile) (H = High Profile)



DRAM APPLICATIONS



BLOCK DIAGRAM OF DRAM SYSTEM

USE BOURNS NETWORKS TO:

- Match impedance between memory driver and the DRAM array.
- · Minimize reflections and ringing in DRAM inputs.
- Prevent undershoot of RAS, CAS, and WE signals which may result in latch-up of DRAM inputs
- Improve system performance by allowing faster setting times for DRAM inputs.

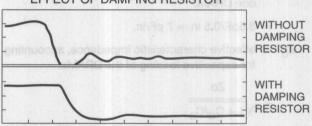
NEED FOR DAMPING

The address lines (RAS, CAS) and control lines (WE) of dynamic RAM arrays are driven in parallel, causing significant loading on the driver of the DRAM arrays. Each DRAM control input (WE) has capacitive loading between 5pF to 7pF, while each address line input has about a 10pF load.

Thus each DRAM input can be modeled as a transmission line with distributed inductance and capacitance. If not properly terminated, signal reflections and ringing on the line will result, adversely affecting the performance of the memory system. The effects on signal transitions will be:

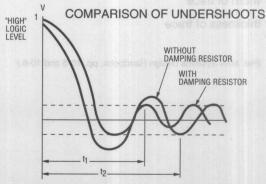
- 1. Increased settling time delay on low-to-high transitions.
- 2. Voltage undershoot on high-to-low transitions.

EFFECT OF DAMPING RESISTOR



Courtesy of B. Narasimhan and J. Shaffer, Micron Techology Corporation.

Increased settling time due to ringing reduces system performance because the design has to allow for the settling delay before sampling the signal. Undershoot, by bringing the input voltage below 0 volts, can damage the driver IC as well as alter the DRAM's internal address register contents, causing potential loss of data.



t₁ - TIME TO ACCEPTABLE "LOW" LOGIC LEVEL FOR DRIVER WITHOUT DAMPING RESISTOR

to - TIME TO ACCEPTABLE "LOW" LOGIC LEVEL WITHDAMPING RESISTOR



DRAM APPLICATIONS

APPLICATION GUIDELINES

Termination of address and control lines is typically accomplished with low-valued resistors placed in series at the driver output. Selection of the proper resistance value is performed in two steps: approximation of the proper resistance using transmission line equations, and secondly, through trial and error, changing the resistance value to account for real world deviations such as PCB vias and bends.

The appropriate transmission line equations are as follows:

Z_O = characteristic line impedance (microstrip)

$$= \sqrt{\frac{87}{\text{er} + 1.41}} \text{ In } \left(\frac{5.98\text{h}}{0.8\text{w} + \text{t}}\right) \text{ ohms}$$

 T_d = propagation delay of the line

= $1.017 \sqrt{0.475e_r + 0.67}$ ns/in.

 C_0 = trace capacitance = 1000 (T_d/Z_0) pF/in.

C_d = equivalent trace capacitance associated with each DRAM. It takes 0.5 inch to interconnect one DRAM.

= 3.5 pF/0.5 in. = 7 pF/in.

Z_O' = effective characteristic impedance, accounting for capacitive loading of the DRAMs.

$$= \sqrt{\frac{Zo}{1 + C_d/C_o}}$$

T_d' = effective propagation delay, accounting for the capacitive loading of the DRAMs

$$T_d = T_d \sqrt{1 + C_d/C_o}$$

where e_r = relative dielectric constant of the PCB's glass epoxy layer

h = distance from the trace to the ground plane

w = width of trace

t = thickness of trace

(Ref. MMI Systems Design Handbook, pp. 10-5 and 10-6.)

For example, for a trace with the following characteristics:

 $e_r = 5$ (for G10 glass epoxy)

h = 30 mils

w = 15 mils

t = 3 mils

then, $Z_0 = 85$ ohms

 $T_d = 0.15 \text{ ns/in.}$

 $C_0 = 1.76 \, \text{pF/in}.$

 $Z_0' = 38 \text{ ohms}$

 $T_{d}' = 0.35 \text{ ns/in.}$

Thus on a theoretical basis, the design will require the resistance of 38 ohms to match the trace impedance of the PCB.

However, the actual impedance will differ from this theoretical value due to the non-ideal characteristics of the PCB trace geometry (i.e., bends, curves and vias in the trace), as well as the manufacturing variations inherent in the components and materials. Therefore, a trial-and-error process must be employed in order to optimize the value of the damping resistor.

The procedure involves selecting various values around the calculated value and observing the resulting waveforms on an oscilloscope. Choose the value that best balances the reduction in ringing/reflection and the reduction in speed: a large resistance value provides better damping, but will also add delay by slowing the edge rate. Typically, resistance values for memory damping will be in the range of 10 ohms to 50 ohms, with the most common values in the 20 ohm to 30 ohm range.

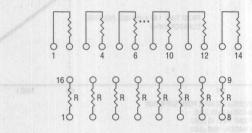
Since memory damping is a type of series termination, distributed loading along the line will not be possible. That is, the entire lumped load must be located at the end of the line, with no other loads along the signal path. This will guarantee that the waveform will remain undisturbed as it travels along the line. For related reasons, the placement of the series damping resistor should be as close to the driving device as possible.

DRAM APPLICATIONS OWIEW ROTSIZES BORUZ MUIS MOINT

BOURNS NETWORKS FOR MEMORY DAMPING

Bourns can supply a wide range of standard resistor networks for memory damping applications. Standard resistance values (see below) are normally in stock. However, any intermediate value within the range 10 ohms to 10 megohms can be supplied.

The following package and pin count options are available:



	0000	NUMBER OF I	LINES	
	2	3	4	5
MSIP* CSIP* PCC	4304M-102-RC 4604X-102-RC	4306R-102-RC 4606X-102-RC	4308R-102-RC 4608X-102-RC	4310R-102-R0 4610X-102-R0 4210P-102-R0
Instan	6	ab of beau n	nikapa na e	orustalem bi
MSIP* CSIP* PCC	4612X-102-RC	the load by follows ¹ :	of benefan as nevig ed	
	7	8	9	10
DIP CSIP* SOM	4114R-001-RC 4614X-102-RC 4814P-001-RC	4116R-001-RC 4816P-001-RC	4118R-001-RC	4120R-001-R0
SOL-J PCC	10141 -001-NO	4416P-001-RC 4416J-001-RC	7	4420P-001-R0 4420J-001-R0 4420P-102-R0

^{*}Medium profile (.250" seated height) and high profile (.350" seated height) are available by placing the letter "M" or "H," respectively, in the fifth position of the part number.

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omponents, which will require component replacement and omponents, which will require component replacement and it temporary instability to a system, resulting in volatile lemmy loss in a computer or other disruptions.

A traited telecommunication application is shown in

painst suige overstitesses. Typically, a drowbar is used for linary protection, while current limiters and clamps are sed as secondary protection.

Contraction (District of the Contraction of the Con

There are several standard telecommunication waveis - 10 x 1000 microsecond, 0.3 x 700 micro-second, 10

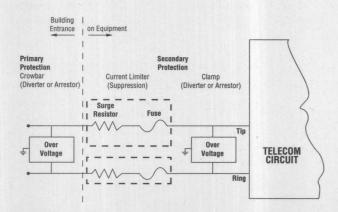
roo marchecond, etc. The deniction of a 10 x 1000 cosecond is shown in Figure 2. The first number refers to a voltage due time while the second numbers indicate the ration. All of these surge pulse waveforms consist of energiation.

THICK FILM SURGE RESISTOR NETWORK

GENERAL DESCRIPTION

Surge is defined as a high-energy, short-duration pulse caused by lightning or the switching of power loads. In short, a surge can be a transient wave of voltage, current or power. Most of the surge pulse waveforms are unidirectional impulses. Surge waveforms occur in many situations, including computer memory drivers and telecommunication equipment. Standards for various natural surge pulse waveforms in the telecommunication industry are IEC 801-5, ANSI/IEEE C62.41 and Bellcore TR-NWT-001089. Two consequences of inefficient surge protection in a system are (1) permanent damage to internal components, which will require component replacement and (2) temporary instability to a system, resulting in volatile memory loss in a computer or other disruptions.

A typical telecommunication application is shown in Figure 1. There are various protection devices which guard against surge overstresses. Typically, a crowbar is used for primary protection, while current limiters and clamps are used as secondary protection.



There are several standard telecommunication waveforms - 10×1000 microsecond, 0.5×700 microsecond, 10×700 microsecond, etc. The definition of a 10×1000 microsecond is shown in Figure 2. The first number refers to the voltage rise time while the second numbers indicate the duration. All of these surge pulse waveforms consist of energy levels from 10 to 100 Joules.

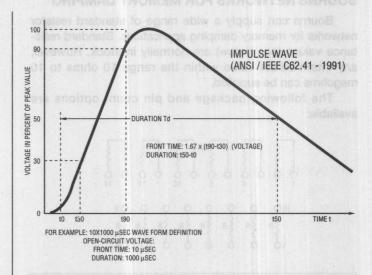


Figure 2. Surge Waveform

SURGE NETWORKS

Surge networks are used to dissipate high energy for a short period of time. Figure 3 shows how the amount of energy is dependent on the pulse duration and value of the load resistance. An equation used to determine the amount of energy transferred to the load by the overstress test waveform can be given as follows 1:

Energy, W =
$$\frac{1}{(Rs + RL)} \cdot \frac{RL}{(Rs + RL)} \int_{0}^{\infty} v^{2}(t)dt$$

where RS = source resistance (W)
RL = load resistance (W)

W = energy (Joules)

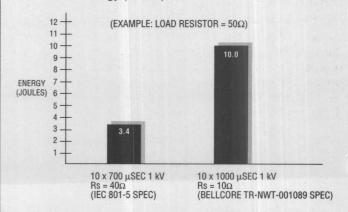


Figure 3. Energy Comparison

Specifications are subject to change without notice.



THICK FILM SURGE RESISTOR NETWORK 19 70 12 Marie 20 14 Marie 20 14

Surge protection is necessary in situations where smaller device geometries and higher densities make circuits susceptible to electrical over stress. Applications include instances where faster processing speeds having less inherent filtering make circuits more susceptible to noise. Also, when vulnerable ICs are used in less-controlled environments, circuits can be exposed to extreme electrical conditions.

COMMON SURGE MODES

There are two common surge modes: (1) metallic, i.e., normal, transverse or differential (Figure 4) and (2) longitudinal, i.e., common (Figure 5). In the metallic surge mode, earth or ground is not involved. Both conductors are metal. Surge current flows from tip to ring or ring to tip. The longitudinal surge mode involves a connection in which the wave is applied between one or more lines and ground. The longitudinal surge current flows from tip to ground and ring to ground.

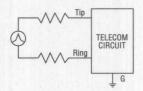


Figure 4. Typical Metallic Application Mode

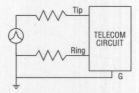


Figure 5. Typical Longitudinal Application Mode

BOURNS THICK FILM SURGE RESISTOR NETWORKS

The Bourns Thick Film Surge Resistor Network provides current limiting for telecommunication protection circuits and consists of two high-power surge resistors, which are utilized in the secondary protection block of central office switch systems (Figure 6). This device protects sensitive circuitry from lightning strikes and power cross-conditions by limiting irregular currents through the system.

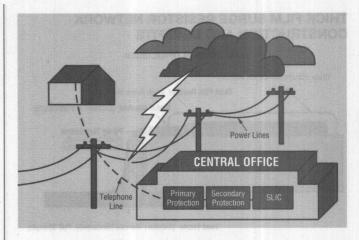


Figure 6. Surge Causes

The thick film surge resistor network features a resistance range between 50 and 100 ohms, resistors that are able to withstand lightning and power conditions per Bellcore specification TR-NWT-001089, noise reduction through close-ratio matching (± percent) between tip and ring resistor pairs and superior material systems created especially for high-power, high-reliability products and applications.

THICK FILM SURGE RESISTOR NETWORK TECHNOLOGY COMPARISON

ELEMENTS	OLDER TECHNOLOGY	STATE-OF-THE-ART TECHNOLOGY
Ceramic thickness	Greater than 0.040 in.	Less than or equal to 0.040 in.
Seated height	Greater than 0.5 in.	Less than or equal to 0.5 in.
Material and process	Standard thick film material and process	New high power material Improved processing
Temperature coefficient of resistance (TCR)	Greater than 100ppm/°C	Less than 100ppm/°C
Tip and ring resistors ratio	1%	0.5% or lower .
Surge test waveforms • 100 cycles • 100 cycles • 10 cycles	10 x 700 μsec 1 kV 10 x 1000 μsec 1 kV	10 x 700 µsec 1 kV 10 x 1000 µsec 1 kV 2 x 10 µsec 2.5 kV
Bias humidity temperature 1000 hr. ΔR	2% or greater	0.25% or lower



THICK FILM SURGE RESISTOR NETWORK AND MULTIPLE MODEL AND ADDRESS OF THE MODEL AND ADDRESS OF T

THICK FILM SURGE RESISTOR NETWORK CONSTRUCTION AND BENEFITS

CROSS-SECTION OF TYPICAL DESIGN

Glaze (Environmental Passivation)

Thick Film Resistor (High Power Material)

Solder Attached (Excellent in Pullstrength)

Pd-Ag Termination (Heat Conductivity, Good Solderability)

Ceramic Substrate

Lead Frame (Excellent Thermal Conductivity, Pull Strength)

The thick film surge resistor network leatures a resisance range between 50 and 100 ohms, resistors that are able to withstand lightning and power conditions per

through close-ratio matching (a percent) between tip and non resistor pairs and superior meterial systems created especially for high-power, high-reliability products and explications

THICK FILM SURGE RESISTOR NETWORK
TECHNOLOGY COMPARISON

Ceramic Hackness Grader User 0.040 in: 1.655 fban or equal to 0.040 in: 1.655 fban or equal to 0.040 in: 1.655 fban or equal to 0.55 fbanderd height Seated height Standard thick film 10.5 fban or equal to 0.5 fbandard thick film 10.5 fban or equal to 0.5 fbandard thick film 10.5 fbandard thick film 10.5 fbandard thick film 10.5 fbandard fbandard thick film 10.5 fbandard fbandard fbandard film 10.5 fbandard fbandar

CUSTOMER ADVANTAGES

The Bourns Thick Film Surge Resistor Network provides customers with tip and ring resistors on the same component for single placement processing. Customer lead times are reduced because parts are readily available. Bourns is an experienced supplier of state-of-the-art thick film overcurrent protection devices. Bourns also has global design and manufacturing centers for localized service.

Specialty devices are available like surge resistor and standard resistors on the same package, fusible links which are "fail safe" integrated with surge resistors and custom electrical configurations and tolerances. The thick film surge resistor also has quick-turn sample times.

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Flgure 5 Typical Longitudinal Application Mode
NNS THICK FILM

The Bourns Thick Film Surge Resistor Network provides unrent limiting for telecommunication protection circuits and consists of two high-power surge resistors, which are tilized in the secondary protection block of central office witch systems (Figure 6). This device protects sensitive sicultry from Unitaling strikes and power cross-conditions

y limiting imagular currents through the system.



THIN FILM APPLICATIONS

Thin film is the preferred generic description for the field of micro-electronics in which conductive, resistive, and/or insulating films are deposited or sputtered on a ceramic or other insulating substrate. The films can be deposited either in a required pattern or as a complete film layer and photo-processed and etched to form the required pattern.

The term "thin film" is derived from the fact that the deposited films are of the order of a few micrometers in thickness compared with the 10 to 50 micrometers for thick film. Often, thin film conductors are plated to improve conductivity.

THIN FILM APPLICATIONS

Thin film resistor networks typically find application in the analog world. The number one use of thin film is in controlling the gain on operational amplifiers. Some other applications are as a stable reference, stable voltage division, stable feedback loops and analog to digital or digital to analog conversion. These networks may also be used for "wire-OR" pull-up, ECL output pull-down, TTL input pull-down, power down pull-up, open collector pull-up, digital pulse squaring, current summing amplifiers, TTL unused gate pull-up, TTL/MOS interfacing, coding and decoding, and telemetry.

Thin film resistors in a network form offer additional benefits in performance. The resistors in a network are more closely matched in resistance and TCR and actually see reduced differentials of temperature in the end use application. These combine to provide improved tracking in networks. This improved tracking would be an advantage to the instrumentation and industrial control markets.

Potential target markets for thin film include harsh environmental conditions as well as the need for precision resistors. The improved ability to be stable at extended temperatures and the increased ability to handle moist environments are both benefits of the thin film offering. Target applications such as automotive and telecommunications will benefit from these capabilities.

THIN FILM VS. THICK FILM

The basic distinction between thick film and thin film is the method of deposition of the metallization. In thick film, specially formulated pastes are applied and fired onto a substrate. The pastes are usually applied with a silk screen method and the substrate is of 96% alumina ceramic. In thin film, a layer of metallization is sputtered onto a substrate and then a pattern is etched into the previously applied metal layer, the substrates are often 99.5% alumina ceramic, silicon, or glass. Thick film is an additive process where layers of termination and resistor material are added to the substrate, while thin film is a subtractive process where the

unwanted material is etched away in a succession of selective photoetching processes. The use of photo-lithographic processes to form thin film patterns produce much finer lines and traces than thick film processes. Thin film is very appropriate for high density and high frequency applications.

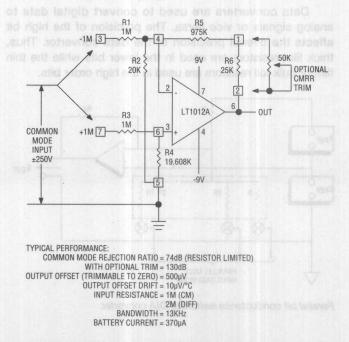
Thick and thin film technologies are well suited for low to medium volume custom circuits. Thick film has the advantages of lower cost (both of tooling up new designs and of production runs), of being able to handle more power, and of being able to service a higher range of ohmic values. Thin film has the advantages of tighter absolute and ratio tolerances and more environmentally stable components with lower noise and tighter TCR than thick film.

Thin film technology is used wherever precision resistors are needed.

DIFFERENTIAL OP-AMP INPUT

Differential Op Amps are needed in electrically dirty environments to reject noise transients that are picked up by wires. The differential Op Amps subtracts the noise out of the two signal wires.

Thin film tracking capabilities are needed in these circuits to ensure that the input resistors do not affect the contents of the incoming signal.



±250V Common Mode Range Instrumentation Amplifier (A_v=1)

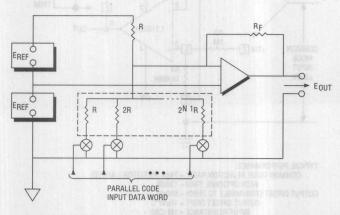
THIN FILM APPLICATIONS

VOLTAGE DIVIDER Was herfole at fallerism beforework

Voltage dividers are used to step down voltages for analog processing. Applications are found in multi-meters, oscilloscopes, oscillator stage of voltage control oscillators, etc. The application needs precise resistors to ensure that errors are not added during the conversion process.

DATA CONVERSION

Data converters are used to convert digital data to analog signals or vice versa. The precision of the high bit affects the overall precision of the data convertor. Thus, thick film resistors are used in the lower bits while the thin film or bulk foil resistors are used in the high order bits.



Parallel bit conductance switching D/A converter.

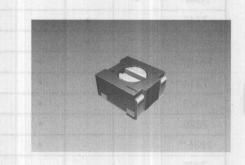
THICK FILM VS. THIN FILM STANDARD VS. PRECISION

Parameter 1999	Thick Film Circuits	Thin Film Circuits
Resistance Resistance Tolerance	3 Ω to 20MΩ .5%, 1%, 2%, 5%	10Ω to 100KΩ .1%, .2%, .5%
TCR	±100ppm/°C	±25ppm/°C
TCR Tracking	100ppm/°C	5ppm/°C
Operating Temperature	-55°C to +125°C	-55°C to +125°C
Max. Operating Voltage	100 volts	50 volts
Resistor Power	.125W to .5W	.1W to .2W
Custom ASP	\$0.20	\$2.00



		N 1 175	
	DATE OF THE		
	FIRST REAL PROPERTY.		

			Swit	ches
	1.	Product Selection Guide	nco85	156
157	II.	Ultra-Miniature Switches		
		Selector		157
		Coded		159
		Rotary		
		Key		168
	III.	Panel Mount Switches		
		6mm		231
		9mm		233
		13mm		237
		16mm		251



PRODUCT SELECTION GUIDE Potentiometer Mounted Switches

		mmer			
	Yea (2 Max.)				
				Conductive Plastic Cernet	
			montJ		



PRODUCT SELECTION GUIDE Ultra-Miniature Switches

Model Number	Function			Mount	ing Type		Si	ze		Packaging Options Actuation		Page		
	Selector	Coded	Rotary	Key	SMT	Leaded	3mm	4mm	5mm	6mm	7	Тор	Side	No.
7643*	•				•				910	ive e	E, G, T	die.	11	157
7644*	•			Tāt.							E, G, T	•		158
7743	100000000000000000000000000000000000000	•	siemali I	ect.			THE EXTEN				E, G, T	•		159
7744*		•		201				•	K-MACH-		E, G, T	•		160
7813**			•		•		•			E 12 Years	E, G, T	•		162
7814			•		•			•		inting	E, G, T			163
7823			•	1231				******	. 5	•		•	•	165
7829		ME SE	•	289,	uş kir eri sa a sa	e in term				•	Smort	•	•	166
7835**			•	365.							E, T	•		167
7906					G#3					•	B, R	•	•	168
7914				•	•	•		•			Е	•		170
7916				•	•					•	Е	•		172

NOTE 1: Standard packaging; some options may require alternate packaging. Consult factory.

T = Tube, B = Bulk, E = Embossed Tape - 7" Reel, G = Embossed Tape - 13" Reel, R = Paper Tape & Reel

PRODUCT SELECTION GUIDE Potentiometer Mounted Switches

Model No.	Turns	Element Type	Tolerance	Tapers	Terminal Style	Package Dim.	Multi. Sec. Avail.	Switch Avail.	Page No.
39	Single	Conductive Plastic	±20%	Linear, Audio	Solder Lugs, PC Pins	13mm	No	Yes	237
85	Single	Conductive Plastic Cermet		Linear, Audio	PC Pins L-Pattern	16mm	Yes	Yes	245
86	Single	Conductive Plastic Cermet		Linear, Audio	J-Hooks L-Pattern	16mm	Yes	Yes	245
97	Single	Conductive Plastic Cermet		Linear, Audio	L-Pattern PC Pins	16mm	Yes (2 Max.)	Yes	251
98	Single	Conductive Plastic Cermet		Linear, Audio	L-Pattern J-Hooks	16mm	Yes (2 Max.)	Yes	251
99	Single	Conductive Plastic Cermet		Linear, Audio	Triangle Pattern Solder Lugs	16mm	Yes (2 Max.)	Yes	251
3370	Single	Conductive Plastic	±20%	Linear	J-Hooks PC Board Bushing Mount	6mm	2 Max.	Yes	231
3310	Single	Conductive Plastic	±20%	Linear	J-Hooks PC Board Bushing Mount	9mm	2 Max.	Yes	233

^{*} Patents pending.

^{**} Patented models.



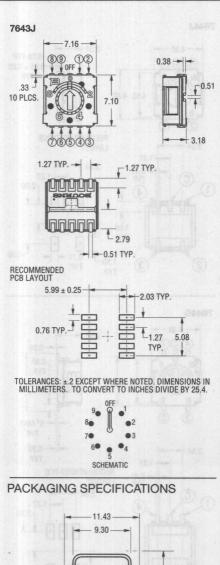
SMD 6MM SQUARE/INDUSTRIAL/SEALED/ 10 POSITION SELECTOR SWITCH

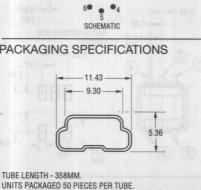
- Miniature industrial switch
- Vertical adjust
- Rugged surface mount design
- Break-before make timing

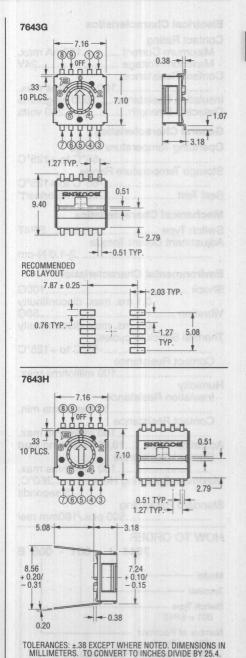
Model 7643

B° Selector Switch

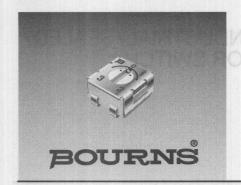
Electrical Characteristics Contact Rating Maximum Current100mA max. Maximum Voltage24V Contact Resistance100 milliohms max. Insulation Resistance1000 megohms Dielectric Strength250 volts **General Characteristics** Operating Temperature Range-55°C to +125°C Storage Temperature Range-55°C to +125°C Seal Test85°C Fluorinert* **Mechanical Characteristics** Switch TypeSP9T Adjustment Detent Torque **Environmental Characteristics** Shock100G 0.1 ms. max. discontinuity Vibration30G 0.1 ms. max. discontinuity Thermal Shock (5 cycles)-55°C to +125°C Contact Resistance100 milliohms max. Humidity Insulation Resistance10 megohms min. Contact Resistance100 milliohms max. Actuation Life10,000 detents no load Contact Resistance100 milliohms max. Maximum Soldering Heat260°C,5 seconds Standard Packaging50 pcs./tube **HOW TO ORDER** 7643 J - 001 - 010 E Model -Terminal Switch Type 001 = SP9T Number of Positions 010 = 10 Positions







("0" Position is Off; Common) Embossed Tape Option (Styles J, G only)



4MM SQUARE/INDUSTRIAL/SEALED/ 5 POSITION SELECTOR SWITCH

- Miniature industrial multi-position switch
- Vertical adjust
- SMD design
- Compatible with all soldering processes
- Patent pending
- Break-before make timing

Model 7644

B° Selector Switch

Electrical Characteristics

Contact Rating
Maximum Current100mA max.
Maximum Voltage24V
Contact Resistance
100 milliohms max.
nsulation Resistance 1000 megohms
Dielectric Strength250 volts
General Characteristics
a little + . A to be to be

Operating Temperature Range

.....-55°C to +125°C Storage Temperature Range Seal Test85°C Fluorinert*

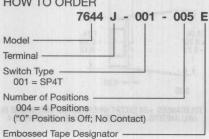
Mechanical Characteristics

Switch Type SP4T

Adjustment Detent Torque	+ 1
2-1.0 N-c	m
Environmental Characteristics	
Shock100	G
0.1 ms. max. discontinui	ty
Vibration30	G
0.1 ms. max. discontinui	ty
Thermal Shock (5 cycles)	
55°C to +125°	C
Contact Resistance	
100 milliohms ma	X
Humidity	
Insulation Resistance	
10 megohms mi	n
Contact Resistance	
100 milliohms ma	
Actuation Life10,000 steps no loa	10
Contact Resistance	
150 milliohms ma	
Maximum Soldering Heat260°0	
5 second	38

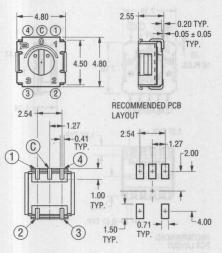
HOW TO ORDER

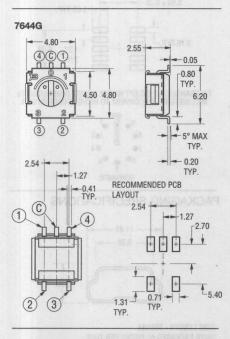
Standard Packaging



.....500 pcs./180mm reel

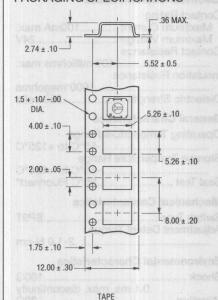
7644J

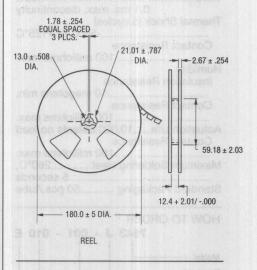




TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.

PACKAGING SPECIFICATIONS









6MM SMD SQUARE/SEALED/ 8, 10 OR 16 POSITION CODED SWITCH

- SMD design
- Rugged lead frame construction
- Compatible with all SMD soldering processes
- Binary coded 8, 10 or 16 position
- Patent pending

Model 7743

B° Coded Switch

Electrical Characteristics

Contact Rating

Maximum Current	IUUIIIA IIIax.
Maximum Voltage	24V
Contact Resistance	
100	milliohms max.
nsulation Resistance	1000 megohms
Dielectric Strength	250 volts

100mA may

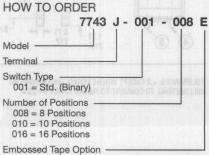
General Characteristics

Switch Type	Binary
Operating Tempera	
	55°C to +125°C
Storage Temperatu	re Range
	55°C to +125°C
Soal Tost	95°C Eluorinart*

Mechanical Characteristics

Positions8.	. 10	or	16
Adjustment Detent Torque			
9	-3	N-0	cm

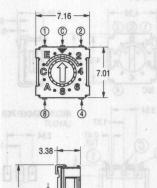
Adjustifient Deterit forque
23 N-cm
Environmental Characteristics
Shock
Vibration30G
0.1 ms. max. discontinuity Thermal Shock (5 cycles)
55°C to +125°C
Contact Resistance
100 milliohms max.
Humidity
Insulation Resistance
10 megohms min.
100 milliohms max.
Actuation Life10,000 steps no load Contact Resistance
100 milliohms max.
Maximum Soldering Heat260°C,

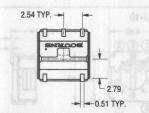


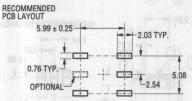
.....5 seconds

Standard Packaging50 pcs./tube

7743J







TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.

10 POSITIONS

-4	1	2	4	8	C
0	VI BY				X
1	X				X
2	100	X	AU310		X
3	X	X	01010	0.5	X
4		4	X	SF ATE	X
5	X	-	X	- (n 2.6	X
5		X	X	- 6	X
7	X	X	X		X
8		o pode	11-11	X	X
9	X		86	X	X

8 POSITIONS

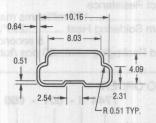
	1	2	4	C
0	(FEE)	ieral	Se pui	X
1	X	1 2-5	230	X
2		X		X
3	X	X		X
4	200	OL 3	X	X
5	X	DO 19	X	X
6	3834	X	X	X
7	X	X	X	X

16 POSITIONS

	1	2	4	8	C
0			-80		X
1	X				X
2		X	27.77	1000	X
3	X	X			X
4		100	X	7	X
5	X	1000	X		X
6		X	X		X
7	X	X	X	-	X
8	nai	100	alb.	X	X
9	X	e i se		X	X
A	rich	X	alb	X	X
В	X	X		X	X
C	27	· (3)	X	X	X
D	X		X	X	X
E	en la	X	X	X	X
F	X	X	Х	X	X

BINARY (REAL) CODE

PACKAGING SPECIFICATIONS



TUBE LENGTH - 383.54MM. UNITS PACKAGED 50 PIECES PER TUBE.



4MM SMD SQUARE/SEALED/ 8 OR 10 POSITION CODED SWITCH

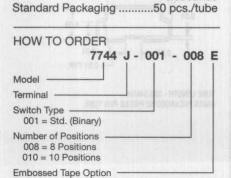
- SMD design
- Rugged lead frame construction
- Compatible with all SMD soldering processes
- Binary coded 8 or 10 position
- Patent pending

Model 7744

B° Coded Switch

Electrical Characteristics

Contact Rating Maximum Current100mA max. Maximum Voltage24V Contact Resistance100 milliohms max.
Insulation Resistance1000 megohms Dielectric Strength250 volts
General Characteristics
Switch TypeBinary Operating Temperature Range55°C to +125°C Storage Temperature Range55°C to +125°C Seal Test85°C Fluorinert*
Mechanical Characteristics
Positions8 or 10 Adjustment Detent Torque
Environmental Characteristics
Environmental Characteristics Shock100G
Environmental Characteristics Shock
Shock
Environmental Characteristics Shock



.....10 megohms min.

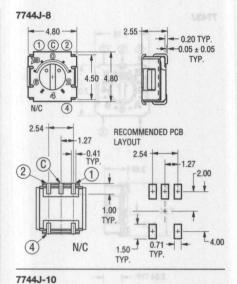
.....100 milliohms max.

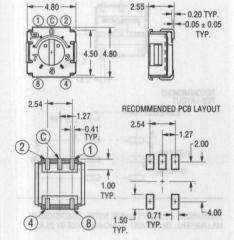
.....100 milliohms max.

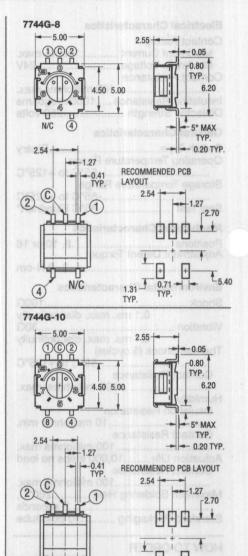
5 seconds

Actuation Life10,000 steps no load

Maximum Soldering Heat260°C,







TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.

(8

1.31

0.71

Humidity

Insulation Resistance

Contact Resistance

Contact Resistance

SMD 3MM SQUARE/SINGLE POLE DOUBLE THROW SEALED/ROTARY SWITCH

- a Compatible with all surface mount manufacturing processes
 - m bu or 2000 cycle rotational life
 - a Tape and reel packaged
 - A SULLIN DEPOS OF THE SERVICE
 - a Low level signal switch

Model 7744

B° Coded Switch

10 POSITIONS

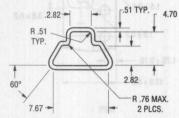
8	PO	SI	TI	0	NS

Wil.	1	2	4	8	C
0		1. 3			X
1	X			W.	X
2		X			X
3	X	X		1	X
2 3 4 5			X		X
5	X		X		X
6		X	X		X
7	X	X	X	0.6	X
8				X	X
9	X			X	X

- 1	1	2	4	C
0				X
1	X			X
2		X		X
3	X	X	Se 87	X
4			X	X
5	X		X	X
6		X	X	X
7	X	X	X	X

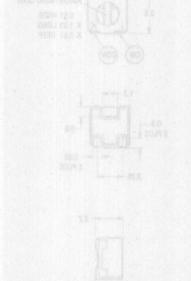
X = CONNECTION

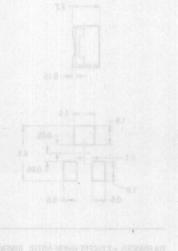
PACKAGING SPECIFICATIONS

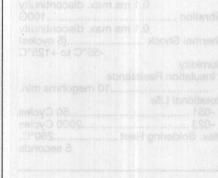


TUBE LENGTH - 523.24MM.
UNITS PACKAGED 100 PIECES PER TUBE.

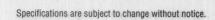


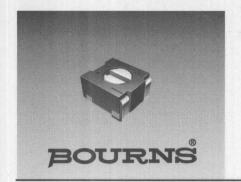






Model 7813





SMD 3MM SQUARE/SINGLE POLE DOUBLE THROW SEALED/ROTARY SWITCH

- Compatible with all surface mount manufacturing processes
- 50 or 2000 cycle rotational life
- Tape and reel packaged
- Withstands 260° soldering heat
- Low level signal switch
- Patent No. 5043695

Model 7813

B° Rotary Switch

Electrical Characteristics

Contact Rating	
Maximum Current	100mA max.
Maximum Voltage	24V
Contact Timing	Non-shorting
Contact Resistance	2 ohms max.
Insulation Resistance	
100 megohn	ns min. (DC500V)
Dielectric Strength	250 VAC

General Characteristics

Cuitab Tim

SWILCH TypeSPDT
Operating Temperature Range
55°C to +125°C
Storage Temperature Range
55°C to +125°C
Seal Test85°C Fluorinert*

Mechanical Characteristics

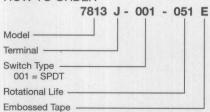
Mechanical Angle	245 $^{\circ}$ ± 15 $^{\circ}$
Positions	2
Adjustment Torque	.5 N-cm max.
Stop Strength	1.8 N-cm min.
Switching Angle	45 $^{\circ}$ ± 5 $^{\circ}$

Environmental Characteristics

OHOUR	200
	0.1 ms max. discontinuity
Vibration	100G
	0.1 ms max. discontinuity
Thermal Shock	(5 cycles)
	-55°C to +125°C
Humidity	
Insulation Re	sistance
	10 megohms min

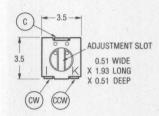
	inegorina min.
Rotational Life	
-051	50 Cycles
-023	2000 Cycles
Max. Soldering Heat	260°C,
	5 seconds

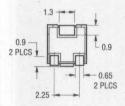
HOW TO ORDER



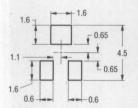
E = 1000 Pcs./180mm Reel (Standard)

7813J





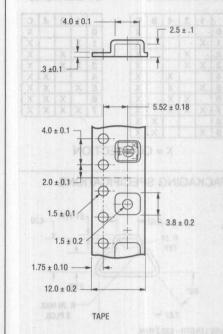


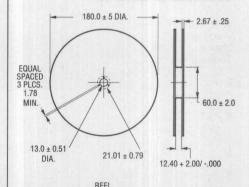


TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



PACKAGING SPECIFICATIONS





Meets EIA 481



SMD 4MM SQUARE/SINGLE POLE DOUBLE THROW SEALED/ROTARY SWITCH

- Compatible with all surface mount soldering processes
- 50 or 2000 cycle rotational life
- Compatible with popular vacuum pick-and-place equipment
- J-hook, gull-wing and through hole
- Meets EIA/EIAJ/IPC/VRCI SMD standard outline dimensions

Model 7814

B° Rotary Switch

FOR PACKAGING SPECIFICATIONS, SEE FOLLOWING PAGE.

Electrical Characteristics

Ontent Delle

Contact Hating	
Maximum Current	100mA max.
Maximum Voltage	24V
Contact Timing	
Contact Resistance	2 ohms max.
Insulation Resistance	
100 megohn	ns min. (DC500V)
Dielectric Strength	250 VAC

General Characteristics

Operating Temperature Range
55°C to +125°C
Storage Temperature Range
55°C to +125°C
Seal Test85°C Fluorinert*
Vibration20G TRS
Shock100G TRS

Switch Type.....SPDT

Mechanical Characteristics

Mechanical Angle	e240° ± 15°
Positions	2
Adjustment Torqu	ue1.8 N-cm max.
	2.5 N-cm min.
Switching Angle	45° ± 5°
Pushover Streng	th (S Style)
9	2 kilograma minimum

Environmental Characteristics

Vibration	20G
Shock	100G
Thermal Shock	(5 cycles)
	-55°C to +125°C
Lle mai alibe	

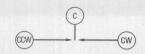
Humidity Insulation Resistance

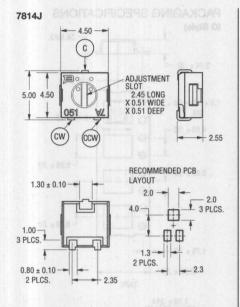
illodiation i looistarioc	
10	megohms min.
Rotational Life	
-051	50 Cycles
-023	2000 Cycles
Max. Soldering Heat	260°C
	10 seconds

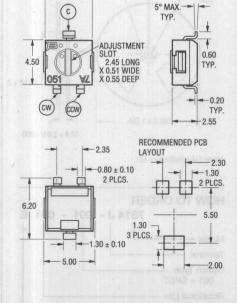
Standard Packaging

_	nailualu i achagilig	
	J & G500	pcs./180mm reel
	S200	pcs./180mm reel
	H	50 pcs./tube

TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.

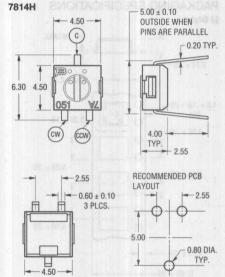




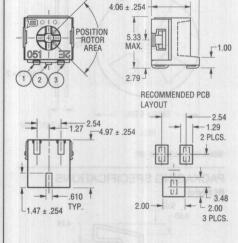


7814G

4.50







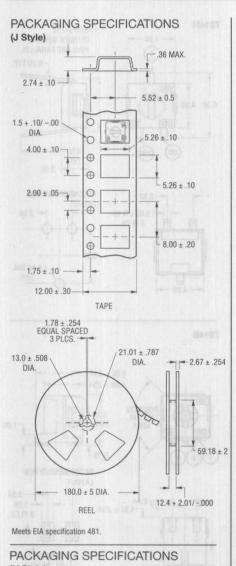
5.00 ± .254

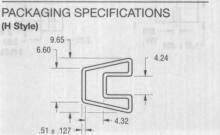
SMD 4MM SQUARE/SINGLE POLE DOUBLE THROW SEALED/ROTARY SWITCH

B[®] Rotary Switch

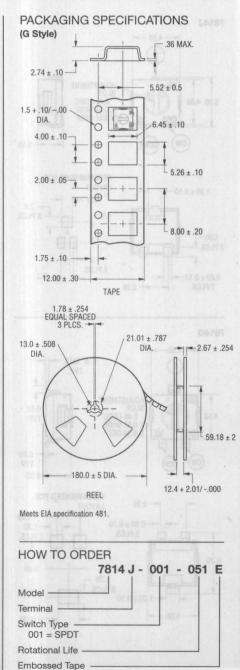
Model 7814

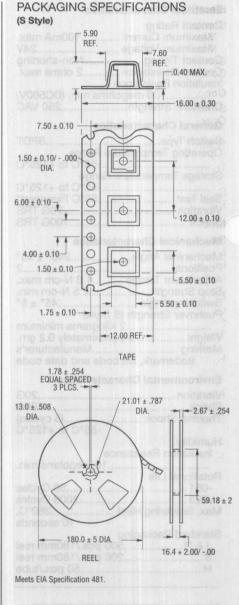
FOR PRODUCT SPECIFICATIONS, SEE PREVIOUS PAGE.





TUBE LENGTH - 523.24MM.
UNITS PACKAGED 100 PIECES PER TUBE.







6MM SQUARE/SINGLE POLE DOUBLE THROW SEALED/ROTARY SWITCH

- Miniature industrial switch
- Vertical adjust
- Board washable
- Rugged construction

Model 7823

B° Rotary Switch

Electrical Characteristics

Contact Rating	
Maximum Current	100mA max.
Maximum Voltage	
Contact Timing	Non-shorting
Contact Resistance	2 ohms max.

General Characteristics

Switch TypeSPDT
Operating Temperature Range
55°C to +125°C
Storage Temperature Range
55°C to +125°C
Thermal Shock5 Cycles
55°C to +125°C
Seal Test85°C Fluorinert*
HumidityIR 10 megohms min.

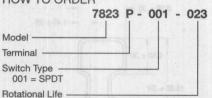
Mechanical Characteristics

Stop Strength	5.6 N.cm
Mechanical Angle	245° ± 15°
Positions	2
Switching Angle	45° ± 5°

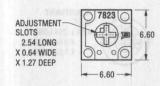
Environmental Characteristics

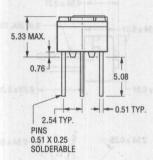
vibration	
Shock	100G
Thermal Shock	(5 cycles)
	-55°C to +125°C
Humidity Insulation Resistant	20
	10 megohms min.
Rotational Life	
-023	2000 Cycles
Standard Packaging	

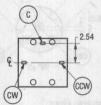
HOW TO ORDER

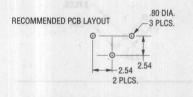


7823P





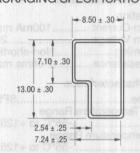




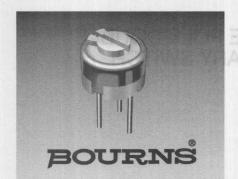
TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



PACKAGING SPECIFICATIONS



TUBE LENGTH - 648 ± 1.50 MM. UNITS PACKAGED 50 PIECES PER TUBE.



6MM THROUGH HOLE ROUND/SINGLE POLE DOUBLE THROW SEALED/ ROTARY SWITCH

- Vertical adjust
- Rugged construction
- Board washable
- Wave solderable

Model 7829

B° Rotary Switch

Electrical Characteristics

Contact Rating	
Maximum Current	100mA max.
Maximum Voltage	24V
Contact Timing	Non-shorting
Contact Resistance	2 ohms max.

General Characteristics

	SPD1
Operating Temperat	ture Range
	55°C to +125°C
Storage Temperatur	re Range
	55°C to +125°C
	5 cycles
	55°C to +125°C
	85°C Fluorinert*

Humidity.....IR 10 megohms min.

Mechanical Characteristics

Stop Strength	3.5 N.cm
Mechanical Angle	245° ± 15°
Positions	2
Switching Angle	45° ± 5°

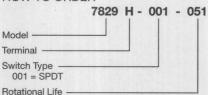
Vibration30G

Environmental Characteristics

Shock	
Thermal Shock	(5 cycles)
	-55°C to +125°C
Humidity	
Insulation Resistanc	
	.10 megohms min.
Rotational Life	
-051	50 Cycles
-023	2000 Cycles

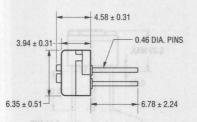
Standard Packaging50 pcs/tube

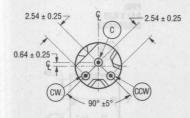
HOW TO ORDER



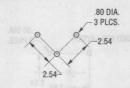
7829H



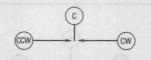




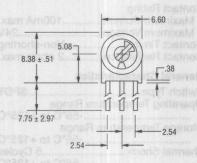
RECOMMENDED PCB LAYOUT

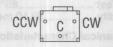


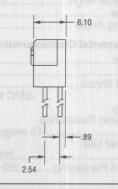
TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



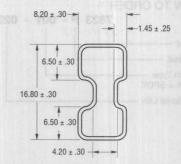
78295







PACKAGING SPECIFICATIONS



TUBE LENGTH - 356 ± 1.50 MM. UNITS PACKAGED 50 PIECES PER TUBE.



SMD 5MM SQUARE/SINGLE POLE DOUBLE THROW SEALED/ROTARY SWITCH

- SMD design
- Packaged in 16mm wide embossed tape, compatible with automatic placement equipment
- Rugged lead frame construction
- Recommended for reflow solder processing only
- Patent No. 4626823

Model 7835

B° Rotary Switch

Electrical Characteristics

Contact Rating	
Maximum Current	100mA max.
Maximum Voltage	24V
Contact Timing	Non-shorting
Contact Resistance	2 ohms max.

General Characteristics

donoral onaraotor	10000
Switch Type	SPDT
Operating Tempera	ture Range
	55°C to +125°C
Storage Temperatu	re Range
	55°C to +125°C
Thermal Shock	5 cycles
	-55°C to +125°C
Seal Test	85°C Fluorinert*
Humidity	.IR 10 megohms min.

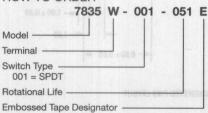
Mechanical Characteristics

Stop Strength	2.8 N.cm
Mechanical Angle	270° nominal
Positions	2
Switching Angle	45° ± 5°

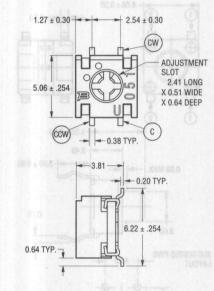
Environmental Characteristics

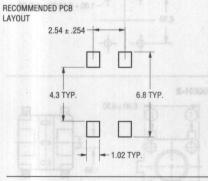
Vibration	30G
Shock	100G
Thermal Shock	(5 cycles)
	-55°C to +125°C
Humidity	
Insulation Resistance	e
	10 megohms min.
Rotational Life	
-051	50 Cycles
Standard Packaging	
50	0 pcs./180mm reel

HOW TO ORDER



7835W

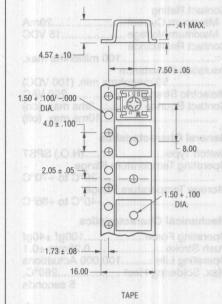


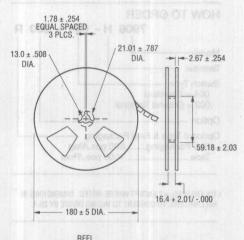


TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



PACKAGING SPECIFICATIONS





Meets EIA specification 481.



6MM SQUARE/SINGLE POLE SINGLE THROW WASHABLE/KEY SWITCH

- Bulk or tape and reel packaging
- Vertical or horizontal actuation
- With or without ground terminal
- Wave solderable

Model 7906

B° Key Switch

Electrical Characteristics

Contact Rating

Maximum Current20mA
Maximum Voltage15 VDC
Contact Resistance
100 milliohms max.
Insulation Resistance
50 megohms min. (100 VDC)
Dielectric Strength250 VAC
Contact Bounce3ms max. (on)
10ms max. (off)

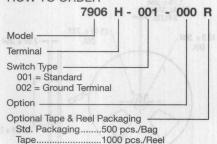
General Characteristics

Switch Type(N.O.) SPST	
Operating Temperature Range	
20°C to +70°C	
Storage Temperature Range	
10°C to 105°C	

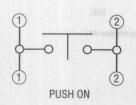
Mechanical Characteristics

Operating Force	100gf ±40gf
Push Stroke	0.25mm ±0.1
Operating Life	100,000 Actuations
Max. Soldering Heat .	260°C,
	5 seconds

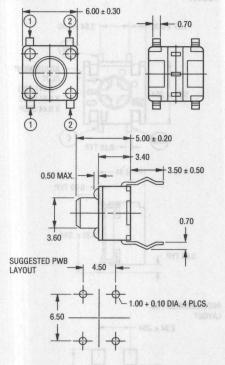
HOW TO ORDER



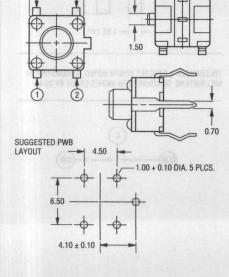
TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



7906H-1

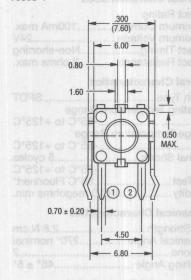


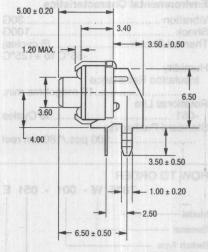
7906H-2



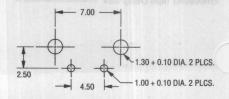
 6.00 ± 0.30

7906S-1





SUGGESTED PWB LAYOUT

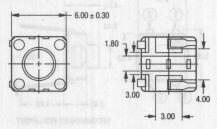


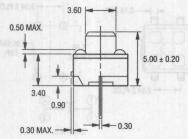
Specifications are subject to change without notice.

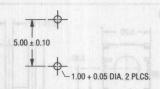
Model 7906

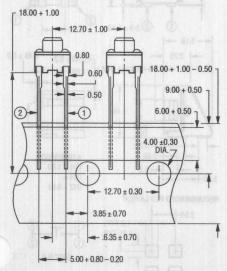
B° Key Switch

PACKAGING SPECIFICATIONS 7906H-1



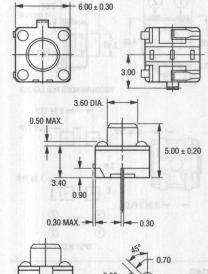


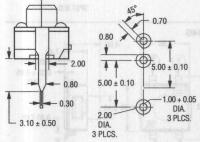


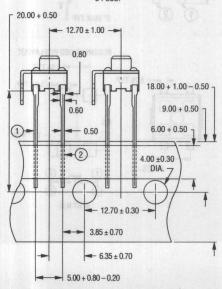


Specifications are subject to change without notice.

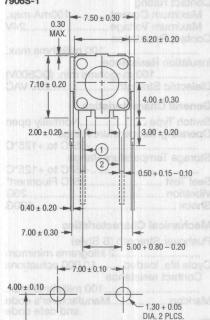
PACKAGING SPECIFICATIONS 7906H-2



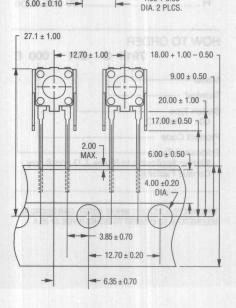




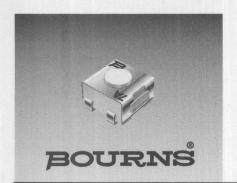
PACKAGING SPECIFICATIONS 7906S-1



 5.00 ± 0.10



1.00 + 0.05



4MM SMD AND THROUGH-HOLE SQUARE/ SEALED/KEY SWITCH

- Compatible with all surface mount soldering processes
- Compatible with popular vacuum pick-and-place equipment
- J-hook, gull-wing and pinned configurations
- Meets EIA/EIAJ/IPC/VRCI SMD standard outline dimensions
- Top or side actuated

Model 7914

B° Key Switch

Electrical Characteristics

Contact Rating

Maximum Current	100mA max.
Maximum Voltage	24V
Contact Resistance	
10	0 milliohms max.
Insulation Resistance	OIL
100 megohm	ns min. (DC500V)
Dielectric Strength	

General Characteristics

Switch Type	Normally open
Operating Temperatu	re Range
	55°C to +125°C
Storage Temperature	Range
	55°C to +125°C
Seal Test	85°C Fluorinert*
Vibration	20G
Shock	100G

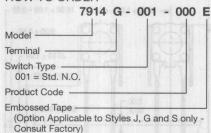
Mechanical Characteristics

Pushover Strength (S Style)
......2 kilograms minimum
Cycle life, loaded10,000 actuations
Contact resistance

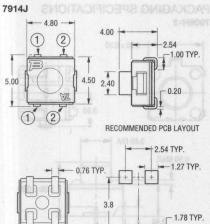
Standard Packaging

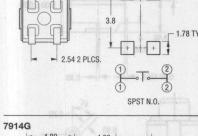
J, G & S	.100	pcs./tube
H		

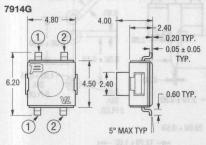
HOW TO ORDER

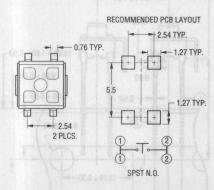


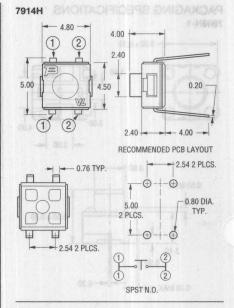
TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.

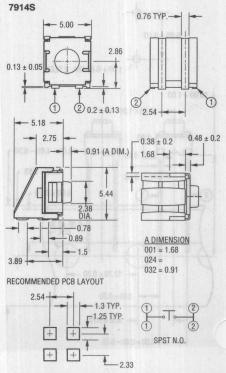












Specifications are subject to change without notice ""Fluorinert" is a registered trademark of 3M Co..

SMD 6MM SQUARE/SINGLE POLES SINGLE THROW WASHABLE/KEY SWITCH

Tage and reel packaged

a trun profile height available

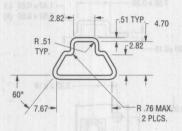
Low level signal switch

Model 7914

B° Key Switch

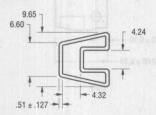
Model 7916

PACKAGING SPECIFICATIONS 7914J, G



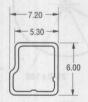
TUBE LENGTH - 523.24MM.
UNITS PACKAGED 100 PIECES PER TUBE.

PACKAGING SPECIFICATIONS 7914H

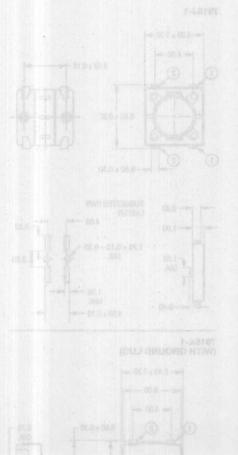


TUBE LENGTH - 523.24MM. UNITS PACKAGED 100 PIECES PER TUBE.

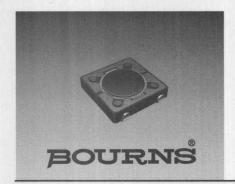
PACKAGING SPECIFICATIONS 7914S



TUBE LENGTH - 524MM.
UNITS PACKAGED 100 PIECES PER TUBE.



Tape Designative on the Peel (Strodent)
at Reel (Strodent)
at 2000 pcs./Reel
at 2000 pcs./Reel



SMD 6MM SQUARE/SINGLE POLE SINGLE THROW WASHABLE/KEY SWITCH

- Compatible with surface mount reflow processes
- Tape and reel packaged
- 1mm profile height available
- Low level signal switch

Model 7916

B° Key Switch

Electrical Characteristics

Contact nating	
Maximum	20mA 15 VDC
Minimum	10 µA 2 VDC
Contact Resistance	
	100 milliohms max.
Insulation Resistance	
50 megol	nms min. (DC100V)
Dielectric Strength	
Contact Bounce	
	10ms max. (off)

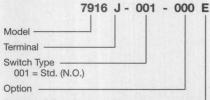
General Characteristics

Switch Type	(N.O.) SPST
Operating Temperature	e Range
	20°C to +70°C
Storage Temperature F	Range
	-10°C to 185°C

Mechanical Characteristics

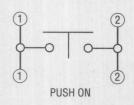
Push Stroke	0.25mm ±0.1
Actuation Force	160 ±50 gf
Operating Life	100,000 Actuations

HOW TO ORDER

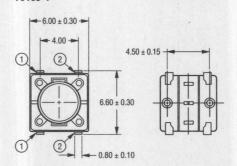


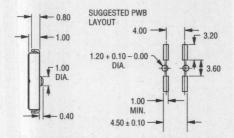
Embossed Tape Designator — E = 370mm Reel (Standard) 7916J-1 = 5000 pcs./Reel 7916X-1 = 2000 pcs./Reel

TOLERANCES: ±.2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.

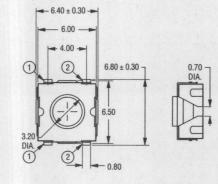


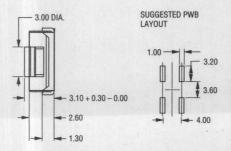
7916J-1



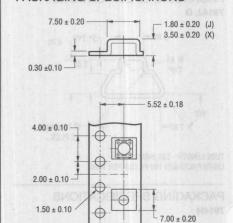


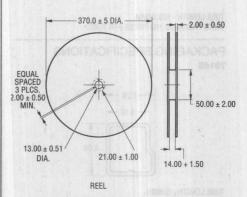
7916X-1 (WITH GROUND LUG)





PACKAGING SPECIFICATIONS





Meets EIA specification 481.

1.75 + 0.10

12.00 ± 0.30

TAPE

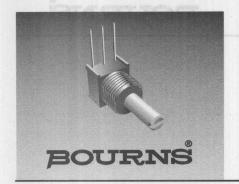
BOURNS

		Encoders
1.	Rotary Encoders	
	6mm Square	174
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	Product Selection Guide	187
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a Long operating life

High operating temperature capabilities





6MM SQUARE / SEALED ENCODER

- Miniature package for design flexibility
- Long operating life
- High operating temperature capabilities
- Conductive plastic element
- Bushing or PC board mount

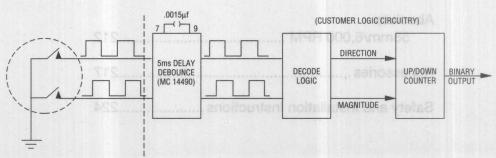
Model 3375

Bourns® Encoders

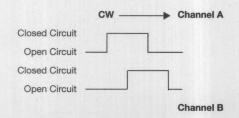
FOR PART NUMBERING SYSTEM, SEE PAGE 176.

Electrical Characteristics Open Circuit Resistance Contact Rating Insulation Resistance (500 VDC) Insulation Resistance (Contact Bounce (15 RPM) RPM (Operating) **Environmental Characteristics** Temperature Range55°C to +125°C Vibration _______50G Contact Bounce _______0.1 millisecond maximum Shock ... Rotational Life **Mechanical Characteristics** Mechanical Angle5 oz-in. maximum

RECOMMENDED INCREMENTAL CONTROL DIAGRAM



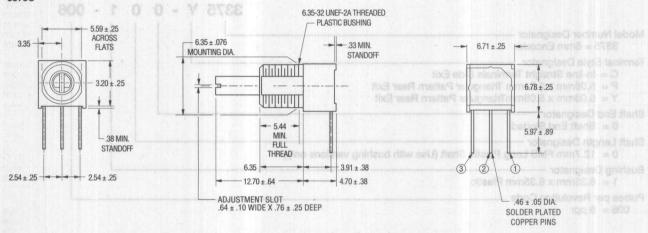
FULL CYCLE 6 PPR STANDARD (Normally Open in Detent Shown)

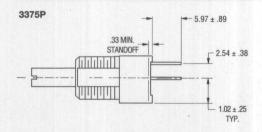


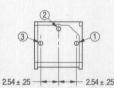
Model 3375

Bourns® Encoders

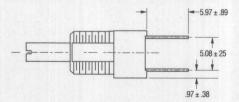
COMMON DIMENSIONS 3375C

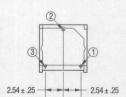


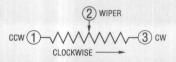




3375Y







Model 3375

Bourns® Encoders

PART NUMBERING SYSTEM

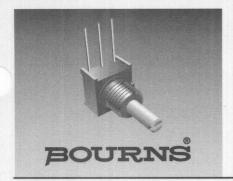
Model Number Designator
3375 = 6mm Encoder

Terminal Style Designator
C = In-line Straight Terminals Side Exit
P = 5.08mm x 2.54mm Triangular Pattern Rear Exit
Y = 5.08mm x 5.08mmTriangular Pattern Rear Exit
Shaft End Designator
0 = Shaft End Slotted

Shaft Length Designator
0 = 12.7mm FMS Long Plastic Shaft (Use with bushing versions only)

Bushing Designator
1 = 6.35mm x 6.35mm Plastic

Pulses per Revolution Code
006 = 6 ppr



9MM SQUARE / SEALED ENCODER

- Miniature package for design flexibility
- Long operating life
- Conductive plastic element
- Bushing or PC board mount

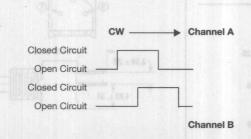
Model 3315

Bourns® Encoders

FOR PART NUMBERING SYSTEM, SEE PAGE 179.

Electrical Characteristics2-bit gray code, Channel A leads Channel B electrically turning clockwise (CW) Open Circuit Resistance..... Contact Rating. Insulation Resistance (500 VDC). Dielectric Withstanding Voltage1,000 megohms minimum Sea Level..... **Environmental Characteristics** Temperature Range..... Contact Bounce.0.1 millisecond maximum Shock..... Rotational Life **Mechanical Characteristics** Mechanical Angle.....5 oz-in. maximumManufacturer's symbol and model number, product code, terminal style, date code and resistance code RECOMMENDED INCREMENTAL CONTROL DIAGRAM .0015µf (CUSTOMER LOGIC CIRCUITRY) DIRECTION 5ms DELAY DECODE UP/DOWN DEROLINCE (MC 14490) LOGIC COUNTER MAGNITUDE

FULL CYCLE 6 PPR STANDARD (Normally Open in Detent Shown)

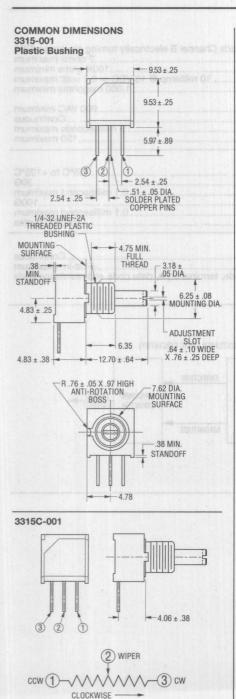


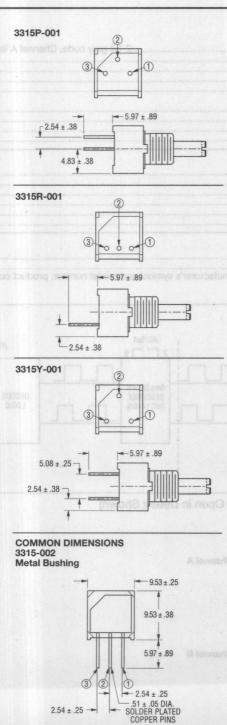
9MM SQUARE / SEALED ENCODER

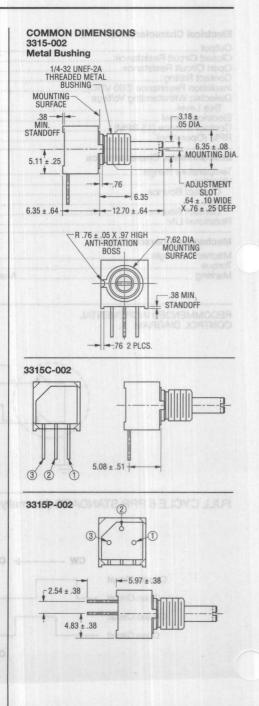
- a Miniature package for design flexibility
 - m Long operating life
 - m Conductive plastic element
 - r Bushing or PC board mount

Model 3315

Bourns® Encoders







Specifications are subject to change without notice.

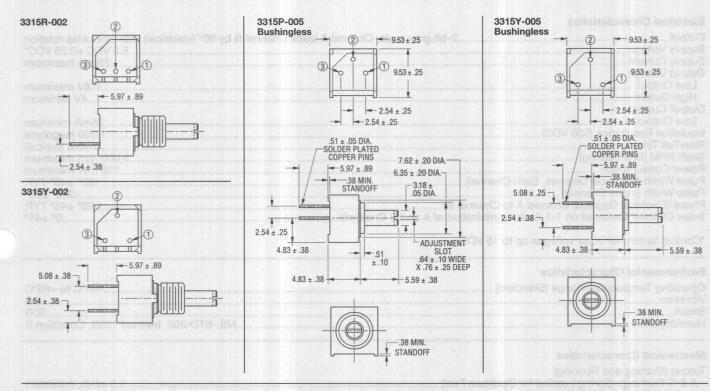
OPTICAL INCREMENTAL ENCODERS

m Index channel available

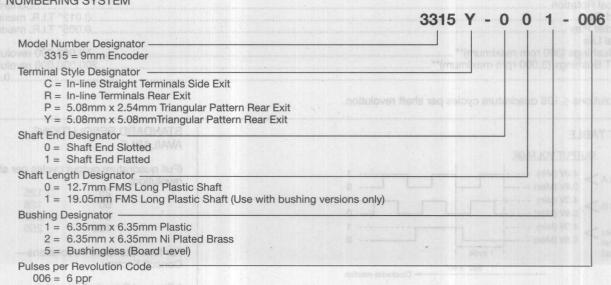
Square wave signal
Small size
CMOS and TTL comp

Model 3315

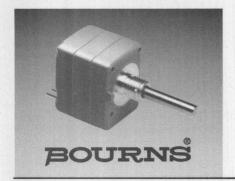
Bourns® Encoders



PART NUMBERING SYSTEM



016 = 16 ppr



OPTICAL INCREMENTAL ENCODERS

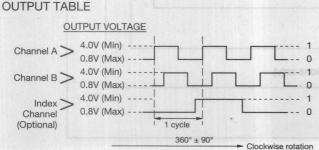
- Two channel quadrature output
- Square wave signal
- Small size
- CMOS and TTL compatible
- Long life
- High operating speed

- Bushing or servo mount
- Index channel available
- Resolution to 256PPR

Rotary Optical Encoders

Bourns® Optical Encoders

Output	2-bit gray code, Channel A leads Channel B by 90° (electrical) with clockwise rotation
Cupply Voltage	z-bit gray code, Chairner A leads Chairner B by 90 (electrical) with clockwise rotation
Supply voltage	5.0 VDC ±0.25 VDC*
Output Voltage	
Output Current	
Low Output	25mA minimum
Insulation Resistance (500 VDC)	1,000 megohms
Rise/Fall Time	
Shaft RPM (Ball Bearing)	
Power Consumption	
Pulse Width (Floatrical Dogrees, Each Channel)
Pulse Width (Electrical Degrees, Each Charmel)	2609 009
Phase (Floatrical Dograda Channel A to Chan	
Phase (Electrical Degrees, Channel A to Chan	el B)
Index Channel Centered on 1-1 State Combin	ation of A and B Channels0° ±45°
*Consult factory for other voltages up to 15 VI	C. Introduction
Environmental Characteristics	
Operating Temperature Bange (Standard)	-40°C to +85°C
Vibration	56
Shock	
U. miditu	MIL-STD-202, Method 103B, Condition B
numary	WIL-STD-202, Metriod 103B, Condition B
Mechanical Characteristics	mounts I
Torque (Starting and Running)	
A & C Bushings (Spring Loaded for Optimum	Feel)
W, S & T Bushings (Ball Bearing Shaft Supple	rt)
Mechanical Rotation	Continuous
Shaft End Play	
Shaft Radial Play	
Rotational Life	The state of the s
W. C. P. T. Dushings (2,000 rpm maximum)**	
Weight	200,000,000 revolutions
vveignt	
**For resolutions ≤ 128 quadrature cycles per	chaft revolution.



AVAILABLE

(Full quadrature output cycles per shaft revolution)

25* 125 50* 128 64 200 100 256

For Non-Standard Resolutions— Consult Factory

^{*} Channel B leads Channel A

ROTARY OPTICAL

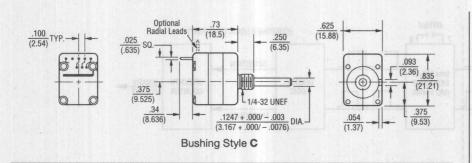
The Bourns® EN model is a self-contained rotary optical encoder. It produces a 2-bit quadrature signal which is suitable for digital systems where both magnitude and direction of adjustment must be provided. The EN encoder is ideal for use as a digital panel control or as a position sensing device in applications where long life, reliability, high resolution and precise linearity are critical.

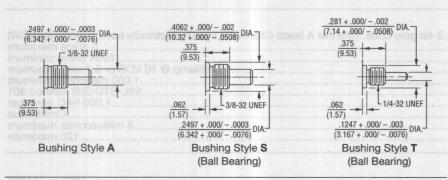
The EN series encoder converts rotary input into electrical signals which can be used by microprocessors without A/D conversion. Bourns encoder output signals are square wave digital pulses which do not require debounce circuitry. Both features make it possible to significantly reduce the memory overhead, wiring and wiring interconnects required by other types of control devices.

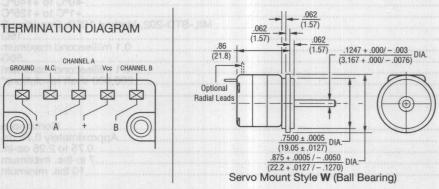
EN optical encoders offer a useful rotational life of from 10 million to 200 million shaft revolutions, making them ideal for extended service applications. The Bourns encoder is also compact and well suited for situations where the available space is limited.

Rotary Optical Encoders

Bourns® Optical Encoders

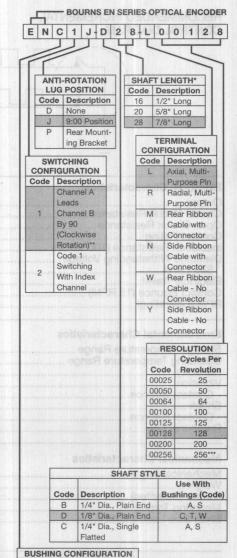






Consult factory for options not shown, including:

- Wire lead or cable options
- Connectors
- Non-standard resolutions
- Special shaft/bushing sizes and features
- Special performance characteristics
- PCB mounting bracket



Shaft length measured from mounting surface. 25 and 50ppr is reversed (Channel B leads Channel A)

3/8"D X 3/8"L Threaded 1/4"D X 1/4"L Threaded

3/8"D X 3/8"L Threaded

***S/T/W bushing only

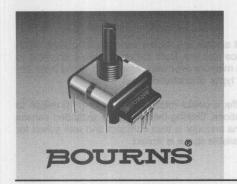
Code Description

(Ball Bearing) 1/4"D X 3/8"L Threaded

(Ball Bearing)

Servo Mount 7/8"D (Ball Bearing)

S

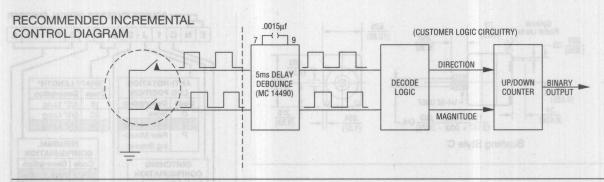


INCREMENTAL ENCODER / QUADRATURE OUTPUT

- Exceptionally long operating life
- High operating temperature capabilities up to 125°C
- Sturdy construction
- Bushing mount
- Available with PC board mounting bracket (optional)

Digital Contacting Encoders

Bourns® Contacting Encoders



Electrical	Characteristics

Output	2-bit gray code, Channel A leads Channel B by 90° electrically turning clockwise (CW)
Closed Circuit Resistance	5 ohms maximum
Open Circuit Resistance	
Contact Rating	
Insulation Resistance (500 VDC)	
Dielectric Withstanding Voltage	MIL-STD-202 Method 301
Sea Level	
Electrical Travel	Continuous
Contact Bounce (15 RPM)	
RPM (Operating)	

Environmental Characteristics

Storage Temperature Range	-40°C to +140°C
Operating Temperature Range	+1°C to +125°C
Humidity	MIL-STD-202, Method 103B, Condition B
Vibration	15G
Contact Bounce	0.1 millisecond maximum
Shock	
Contact Bounce	
Rotational Life	200,000 shaft revolutions*

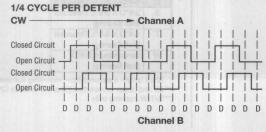
Mechanical Characteristics

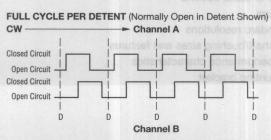
Mechanical Angle	
Weight	Approximately 0.75 oz.
Torque (Detented)	
Mounting Torque	7 in-lbs. maximum
Shaft Side Load (Static)	10 lbs. minimum

*Applies to EC Option.

QUADRATURE OUTPUT TABLE

This table is intended to show available outputs as currently defined.





DIGITAL CONTACTING

The Digital Contacting Encoder is commonly referred to by such names as Digital Panel Control, Bit Switch, Gray Switch and Digital Switch. All such names are synonymous with a device whose output is a digital gray code signal, rather than a conventional potentiometric voltage ratio output.

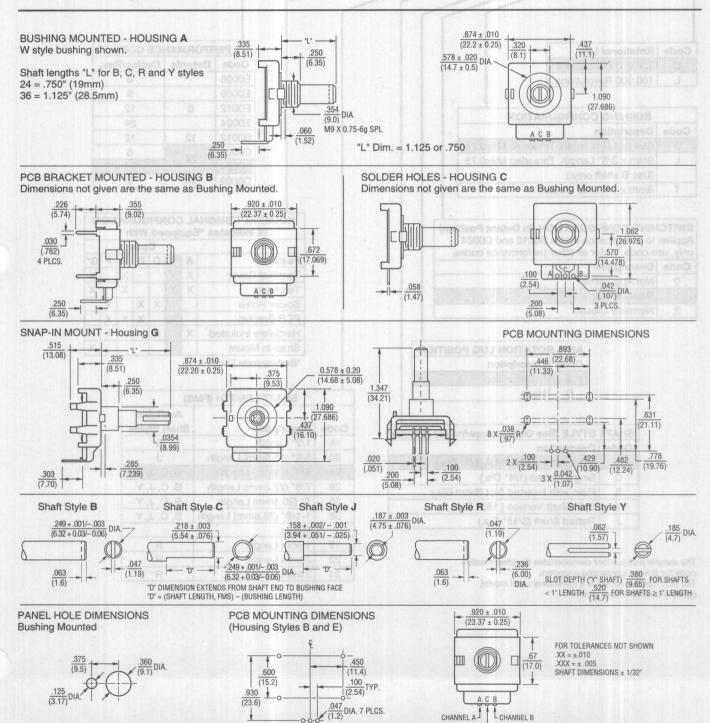
The advantage of the Digital Contacting Encoder is that it permits the direct entry of digitized analog data into a digital circuit without A/D

conversion. The two (2) channel gray coded signal of this incremental encoder allows the user's decoder circuit to sense analog direction of rotation, as well as up-down counter capabilities . . . all without the time and cost required for A/D conversion. This approach can reduce memory overhead, wiring and wiring interconnects, and can provide greater MPU program speed.

Digital Contacting Encoders

Bourns® Contacting Encoders

FOR ORDERING INFORMATION, SEE FOLLOWING PAGE



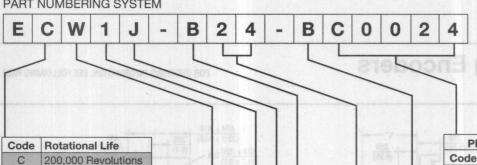
COMMON



HOW TO ORDER **Digital Contacting Encoders**

Bourns® Contacting Encoders





BUSHING CONFIGURATION			
Code	Description		
W	9mm x 1/4" Length. Threaded M9x0.75		
L	9mm x 3/8" Length. Threaded M9x0.75		
	(Use B shaft only.)		
T	9mm x 1/4". No Thread		

100,000 Revolutions

	PERFORMANCE CODE						
	Code	Detents	Cycles/Rev.				
	E0006	manks a	6				
	E0009		9				
-	E0012	0	12				
	E0024		24				
	B0012	12	12				
	C0006	24	6				
	C0024	24	24				
	D0009	36	9				

SWITCHING CONFIGURATION (In Detent Position) Applies to performance codes B0012 and C0024

Code	Description
0	Not Applicable
1	Normally Open
2	Normally Closed

ANTI-ROTATION LUG POSITION		
Code	Description	
J	9:00 Position	
D	None	

J	9:00 Position
D	None

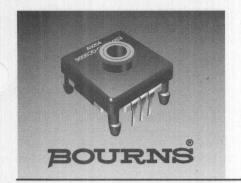
SHAFT STYLE (See Outline Drawing for Details)				
Code	Description			
В	Plain with Inserted Slot (1/4" Dia.)			
С	Single Flatted (1/4" Dia.)			
R	Plain with Inserted Slot (6mm Dia.)			
Y	Split Shaft Version (.185" Dia.)			
J	Flatted Shaft (3/16" Dia.)			

The sample part number demonstrates the identification code for Bourns contacting encoders. The part number shown is a commonly used model, typically available from stock.

HOUSING TERMINAL CONFIGURATION (X indicates "Equipped With"							
In Advantage	Code						
Features	A	В	C	D	E	F	G*
Terminal Cover	X	X			X		X
Terminals	X	X			X	Ti	X
Solder Holes			X	X		X	
PCB Bracket		X		X	X	X	
Hardware Included	X		X	gni	X	X	TVI
Snap-In Mount		- 1				1	X

^{*}Bushing code T only.

Code	SHAFT LENGTH (FM Description	Available Shaft Styles		
16	1/2" Length	В		
20	5/8" (15.9mm) Length	J		
24	3/4" (19mm) Length	B, C, J, Y		
28	7/8" (22.2mm) Length	B, C, J, Y		
32	1" (25.4mm) Length	B, C, J, Y		
36	1-1/8" (28.6mm) Length	B, C, J, Y		
TODAY 133	Metric	4 87 S		
19	19mm Length	R		
22	22mm Length	R		
24	24mm Length	R		



SHAFTLESS INCREMENTAL ENCODER / QUADRATURE OUTPUT

- Snap-in PC board mount
- Long operating life
- Incremental output
- Up to 24 full quadrature outputs per revolution

Shaftless Contacting Encoders

Bourns® Contacting Encoders

FOR ORDERING INFORMATION, SEE FOLLOWING PAGE.

Electrical Characteristics

Output	2-bit gray code, Channel A leads Channel B by 90° electrically turning clockwise (CW)
Closed Circuit Resistance	2-bit gray code, Channel A leads Channel B by 90° electrically turning clockwise (CW)
Open Circuit Resistance	100K ohms minimum
Contact Rating	
Insulation Resistance (500 VDC)	1,000 megohms minimum
Dielectric Withstanding Voltage	MIL-STD-202 Method 301
Sea Level	
Electrical Travel	Continuous
Contact Bounce (15 RPM)	5 milliseconds maximum
RPM (Operating)	120 maximum

Environmental Characteristics

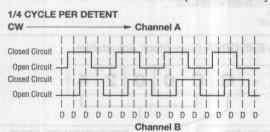
Storage Temperature Range	-40°C to +140°C
Operating Temperature Range	+1°C to +125°C
Operating Temperature Range	MIL-STD-202, Method 103B, Condition B
	15G
Contact Bounce	
Shock	50G
Contact Bounce.	

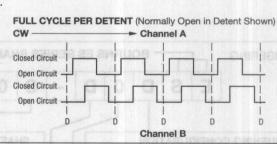
Mechanical Characteristics

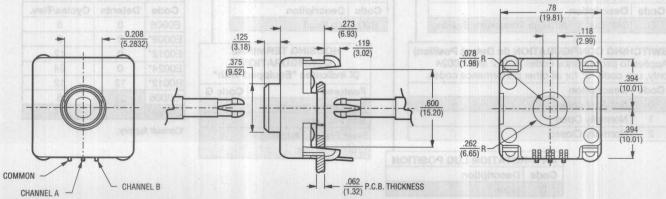
Mechanical Angle	Continuous
Weight	Approximately 0.75 oz.
Rotational Life	
Torque (Detented)	

QUADRATURE OUTPUT TABLE

This table is intended to show available outputs as currently defined.







Specifications are subject to change without notice.

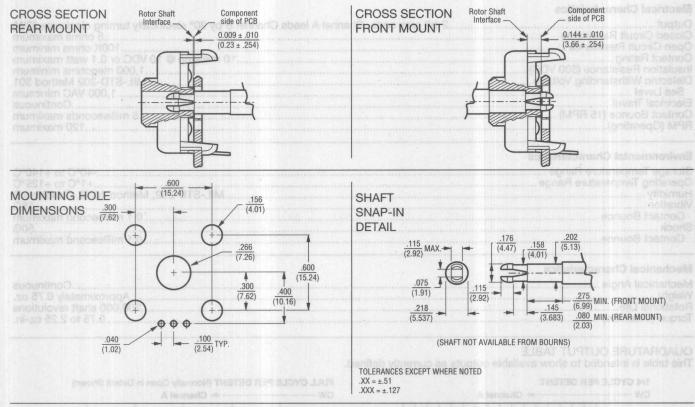
SHAFTLESS INCREMENTAL ENCODER / QUADRATURE OUTPUT

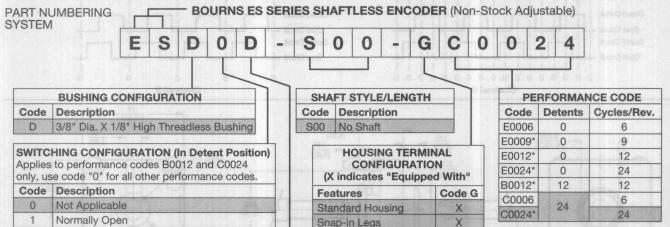
e Incremental cutput

Shaftless Contacting Encoders

Bourns® Contacting Encoders

FOR PRODUCT SPECIFICATIONS, SEE PREVIOUS PAGE.





Rear Facing Terminals - .100" Spacing

Code Description

D None

ANTI-ROTATION LUG POSITION

Specifications are subject to change without notice.

*Consult factory.

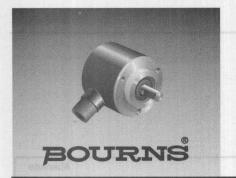
Normally Closed



PRODUCT SELECTION GUIDE OPTO-ASIC ENCODERS

Encoder self tests for disk contamination, disk breakage, over-

	Incremental Encoder						Absolute Encoder		
	Economic Type • Low shaft load • Low resolution • Low enclosure class Industrial Type • High shaft load • High resolution • High enclosure class • High speed	Odel B	NI O						
ligg-neu9		esar sides er elime		MOD	EL				toptot
Mechanical Characteristics	BI 31	BI 32	BI 39	BI 30	BI 36	BI 58	BI 58-D	BI 58-H	BA 58
Shaft Diameter (mm)	5	5; 6	6	5	6	6; 10	10; 12	10; 12	6; 10
Shaft Diameter (inches)	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"; 3/8"	Hollow Shaft	Hollow Shaft	1/4"; 3/8"
Max. Speed (RPM)	4000	6000	4000	10000	10000	10000	6000	3000	6000
Bearing Type	Sleeve	Ball	Sleeve	Ball	Ball	Ball	Ball	Ball	Ball
Protection Class (DIN)	IP 42	IP 50	IP 42	IP 65	IP 65	IP 65/IP 67	IP 65	IP 64	IP 65
Size (mm)	30	30	39x39	30	36	58	58	58	58
Electrical Characteristics								(5. V)	Push-Pull Jarm Outgi Push-Pul
Resolution	1024	1500	1024	1500	3600	10000	5000	5000	24 bit
Supply Voltage (VDC)	5, 10-30	5, 10-30	5, 10-30	5, 10-30	5, 10-30	5, 10-30	5, 10-30	5, 10-30	5, 10-30
Output Circuit	Push/Pull	Push/Pull	Push/Pull	Push/Pull RS422	Push/Pull RS422	Push/Pull RS422	Push/Pull RS 422	Push/Pull RS422	Push/Pull RS422



INCREMENTAL SHAFT ENCODER WITH OPTO-ASIC

- An economical instrument style encoder
- Short circuit and overload protection (10-30V)
- Encoder self tests for disk contamination, disk breakage, overtemperature, undervoltage and excessive LED aging, and provides an alarm output if these conditions occur.

* Low shaft load

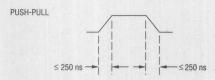
Model BI 31

Bourns® Encoders

Electrical Characteristics							
Output			ings.				Push-pu
General Design							As per DIN VDE 016
Supply Voltage	86.83	.,					5 VDC, 10-30 VDC
Power Consumption							30 mA (24 VDC), 40 mA (5 VDC
Pulse Frequency							200 kHz, 300 kHz (5 V
Output H Harle wollold Marke wollo							
Push-Pull (10-30 V) Push-Pull (5 V)							
Output L						guagi2	
Output L Push-Pull (10-30 V)							≤2 \
Push-Pull (5 V)	178 9086 9	88 91	88 91	IP 42	12.50	16.45	≤ 0.5
Maximum Output Load Push-Pull (10-30 V)			176		US US	1	±30 m/
Push-Pull (5 V)							
Marm Output							
Push-Pull (10-30 V)							O.C. NPN 10 m
Push-Pull (5 V)							O.C. NPN 10 m
T doi: T dir (o v)							
Environmental Characteristics							
Operating Temperature Range Storage Temperature Range/ibration Proof							25°C to +85°C
Shock Resistance							1,000 ms ⁻² (3 ms
Mechanical Characteristics							
Shaft Diameter							5mr
Absolute Maximum Shaft Load							
Absolute Maximum Speed							
Forque							
Protection (DIN 40050)							
Connection Materials							
Flange							
Weight							50 g approx
Bearing Life		6 x 1	revolution	ns (typ.), for	example 1	J,000 h at	1,000 RPM with a 2lb. radial loa

DELAY TIMES FOR 1.5M CABLE

Pulse shape: \(\square\) Pulse duty factor: 1:1 Tolerance: ± 25° electrical

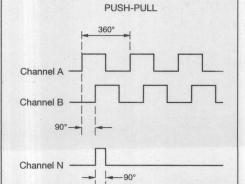


*DISTANCE FROM A TO B IS AT LEAST 0.45 µs.

SHORT CIRCUIT AND OVERLOAD PROOF OVER THE WHOLE TEMPERATURE RANGE. POLARITY PROTECTION.

OUTPUT TABLE (Shaft turning clockwise as seen from

front of encoder)



CABLE LENGTHS @ 25° WITH RESPECT TO BOURNS CABLES (depends on voltage and frequency)

LENGTH	PUSH-PULL		
10m max.	5 VDC, 300 kHz 12 VDC, 200 kHz 24 VDC, 200 kHz 30 VDC, 200 kHz		

Consult factory for other lengths.

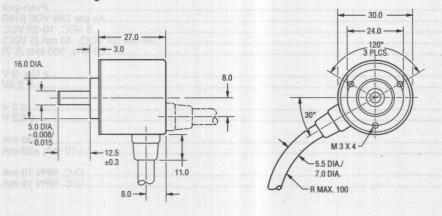
INCREMENTAL SHAFT ENCODER WITH OPTO-ASIC

- Round flange Prints (13.1 Avieseoxa bris egistlovishni) ejutistegmet
- Protection class IP 42

Model BI 31

Bourns® Encoders

Dimensional Drawings

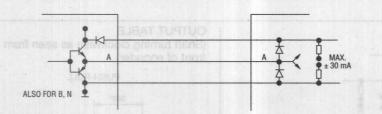


CONNECTION DIAGRAM

Push-Pull	Lead Diameter mm ¹	Color
5 VDC ± 10%/10-30 VDC	0.50	Red
Channel A	0.14	White
Channel B	0.14	Green
Channel N	0.14	Yellow
GND	0.50	Black
Alarm and and and	0.14	Yellow/Black

¹ Depends upon ordering code

OUTPUT CIRCUIT

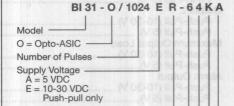


D, K = PUSH-PULL (SHORT CIRCUIT PROOF AND OVERLOAD PROOF)

TOLERANCES EXCEPT WHERE NOTED (DIN 7168):

0-6mm	±0.1
6-30mm	±0.2
30-120mm	±0.3

HOW TO ORDER



Type of Flange
R = Round Flange
Enclosure Class
6 = IP 42

Shaft Diameter - 4 = 5mm

Output — K = Push-Pull Short Circuit Proof D = Push-Pull, 5V, ±30 mA

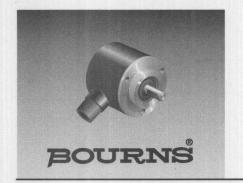
Type of Connection – A = Cable Axial B = Cable Radial

STANDARD RESOLUTIONS AVAILABLE

5	60	500
10	100	512
20	128	600
25	200	900
30	256	1000
50	360	1024

Consult factory for non-standard resolutions.

For accessories, see pages 217-223.



INCREMENTAL SHAFT ENCODER WITH OPTO-ASIC

- The economical encoder for small appliances
- Short circuit and overload protected
- Encoder self tests for disk contamination, disk breakage, over temperature, undervoltage and excessive LED aging, and provides an alarm output if these conditions occur.

Model BI 32

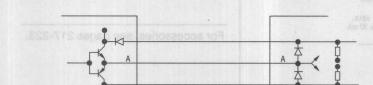
Bourns® Encoders

Electrical Characteristics			
Output			Push-pull
General Design			
Supply Voltage			
Power Consumption		30 r	nA (24 VDC), 40 mA (5 VDC)
Pulse Frequency			200 kHz. 300 kHz (5 V)
Output H			
Push-Pull (10-30 V)			> Up -3 V
Push-Pull (5 V)			
Output L			
Push-Pull (10-30 V)			<2 V
Push-Pull (5 V)		18.)	< 0.5 V
Maximum Output Load			
Push-Pull (10-30 V)			+30 m∆
Push-Pull (5 V)		· · · · · · · · · · · · · · · · · · ·	+10 mA +30 mA
Alarm Output		AA:	
Alarm Output Push-Pull (10-30 V)			OC NPN 10 mA
Push-Pull (5 V)			OC NON 10 mA
rusii-ruii (5 v)	The state of the s	M	O.O. NEN TOTAL
Environmental Characteristics			
Operating Temperature Range			10°C to +60°C
Storage Temperature Range			
Vibration Proof			
Shock Resistance			
Mechanical Characteristics Shaft Diameter			
Mechanical Characteristics			
Shaft Diameter			5mm, 6mm
Absolute Maximum Shaft Load		Radial 30 N	(6.5 lbs.), axial 15 N (3.3 lbs)
Absolute Maximum Speed			Max. 6,000 RPM
Torque			≤1 Ncm
Protection (DIN 40050)	West of the second seco	HEAD TO THE REST OF THE REST O	IP 50
Connection	3088	58.0	1.5m cable axial/radial*
Material			
Flange			
Moight			En a approx
Bearing Life			
		2.4 x 10 ⁹ revolutions (tvp.) at	35% of full rated shaft load
		2,4 x 10 ⁹ revolutions (typ.) at 2.4 x 10 ⁸ revolutions (typ.) at	35% of full rated shaft load
		2,4 x 10 ⁹ revolutions (typ.) at 2,4 x 10 ⁸ revolutions (typ.) at	t 35% of full rated shaft load t 75% of full rated shaft load
			t 35% of full rated shaft load t 75% of full rated shaft load 100% of full rated shaft load

*Other lengths of cable available on request.

OUTPUT CIRCUIT

ALSO FOR B, N

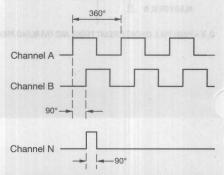


K, D = PUSH-PULL (SHORT CIRCUIT PROOF AND OVERLOAD PROOF)

OUTPUT TABLE

(Shaft turning clockwise as seen from front of encoder)





Specifications are subject to change without notice.

■ Short circuit proof and overload protected (10-30V)

a The economical encoder for small appliances

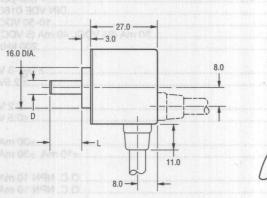
u To 4,096 steps at 1,024 impulses

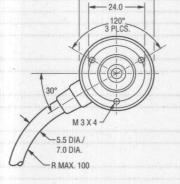
- Round flange
- Encoder self tests for disk contamination, disk break ■ Protection class IP 50 and revise one applications and the protection class IP 50 and revise one applications and the protection class IP 50 and revise one applications are protection class.

Model BI 32

Bourns® Encoders

Dimensional Drawings





30.0 -

5MM DIAMETER 6MM DIAMETER

12 5MM 10.0MM

CONNECTION DIAGRAM

Push-Pull	Lead Diameter mm ¹	Color
5 VDC ± 10%/10-30 VDC	0.50	Red
Channel A	0.14	White
Channel B	0.14	Green
Channel N	0.14	Yellow
GND	0.50	Black
Alarm	0.14	Two-colored

1 Depends upon ordering code 11,575 of 000 statements and 1500 sta

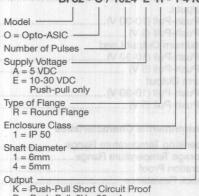
For accessories, see pages 217-223.

TOLERANCES EXCEPT WHERE NOTED (DIN 7168):

0-6mm	±0.1	
6-30mm	±0.2	
30-120mm	±0.3	

HOW TO ORDER

BI 32 - O / 1024 E R - 1 4 K A



D = Push-Pull, 5V, ±30 mA Type of Connection

A = Cable Axial B = Cable Radial

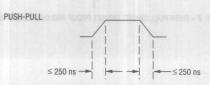
STANDARD RESOLUTIONS AVAILABLE

5	60	360	1000
10	100	400	1024
20	128	500	1250
25	200	512	1500
30	250	600	
50	256	900	

Consult factory for non-standard resolutions.

DELAY TIMES FOR 1.5M CABLE

Pulse shape: _ Pulse duty factor: 1:1 Tolerance: ± 25° electrical



*DISTANCE FROM A TO B IS AT LEAST 0.45 us.



INCREMENTAL SHAFT ENCODER WITH OPTO-ASIC

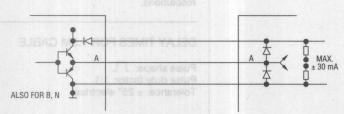
- The economical encoder for small appliances
- To 4,096 steps at 1,024 impulses
- Short circuit proof and overload protected (10-30V)
- Encoder self tests for disk contamination, disk breakage, overtemperature, undervoltage and excessive LED aging, and provides an alarm output if these conditions occur

Model BI 39

Bourns® Encoders

Electrical Characteristics OutputPush-pull General DesignDIN VDE 0160 Push-Pull (10-30 V)≥ U_B -3 V Push-Pull (5 V)≥ 2.5V Push-Pull (10-30 V).....≤ 2 V Push-Pull (5 V)≤0.5 V Maximum Output Load Push-Pull (10-30 V).....±30 mA Alarm Output **Environmental Characteristics** Operating Temperature Range-10°C to +60°C Storage Temperature Range -25°C to +85°C Vibration Proof 100 ms⁻² (10-2000 Hz) Shock Resistance 1,000 ms⁻² (3 ms) **Mechanical Characteristics** Connection Round cable, radial

OUTPUT CIRCUIT



D, K = PUSH-PULL (SHORT CIRCUIT PROOF AND OVERLOAD PROOF)

CABLE LENGTHS @ 25° WITH RESPECT TO BOURNS CABLES (depends on voltage and frequency)

LENGTH	PUSH-PULL
10m	5 VDC, 300 kHz 12 VDC, 200 kHz 24 VDC, 200 kHz 30 VDC, 200 kHz

Consult factory for other lengths.

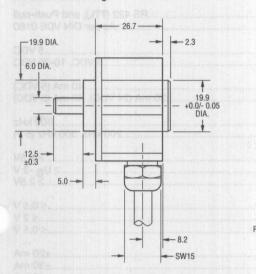
NOREMENTAL SHAFT ENCODER WITH OPTO-ASIC

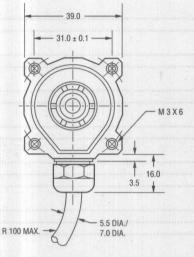
- Square form
- Front and back mounting
- Square flange 39 x 39mm
- Protection class IP 42

Model BI 39

Bourns® Encoders

Dimensional Drawings





sealucimi 003 f is again 000,3 of w

s Short circuit proof and overload protected

CONNECTION DIAGRAM

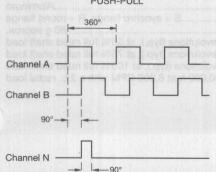
Push-Pull	Lead Diameter mm ¹	Color
5 VDC ± 10%/10-30 VDC	0.5	Red
Channel A	0.14	White
Channel B	0.14	Green
Channel N	0.14	Yellow
GND	0.5	Black
Alarm	0.14	Yellow/Black

¹ Depends upon ordering code

OUTPUT TABLE

(Shaft turning clockwise as seen from front of encoder)

PUSH-PULL

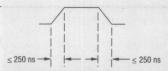


Specifications are subject to change without notice.

DELAY TIMES FOR 1.5M CABLE

Pulse shape: L Pulse duty factor: 1:1 Tolerance: ± 25° electrical

PUSH-PULL



*DISTANCE FROM A TO B IS AT LEAST 0.45 µs.

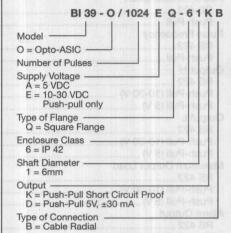
SHORT CIRCUIT AND OVERLOAD PROOF OVER THE WHOLE TEMPERATURE RANGE. POLARITY PROTECTION.

TOLERANCES EXCEPT WHERE NOTED (DIN 7168):

0-6mm ±0.1 6-30mm ±0.2

30-120mm ±0.3

HOW TO ORDER



STANDARD RESOLUTIONS AVAILABLE

10	60	360
20	72	500
25	100	512
28	128	1000
32	200	1024
50	256	

Consult factory for non-standard resolutions.

For accessories, see pages 217-223.



INCREMENTAL SHAFT ENCODER WITH OPTO-ASIC

- The industry standard economical encoder
- EMC class IV as per IEC 801
- To 6,000 steps at 1,500 impulses
- Short circuit proof and overload protected (10-30V)
- Synchro flange and round flange

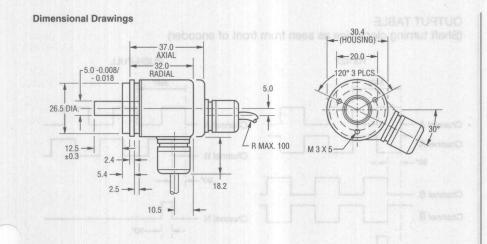
Model BI 30

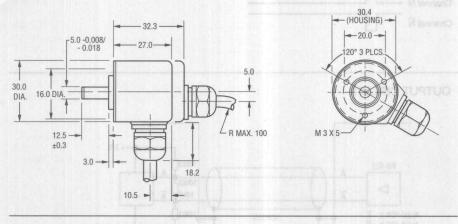
Output 10 roman		ch-nu
DC 400	(D) (31) (D)	E VIDO
	5 VDC, 10-3	SO ADC
Power Consumption		FVDC
	40 mA (
		5 VDC
Pulse Frequency		
	3	
Push-Pull		1z (5 V
Output H		
RS 422		.≥ 2.5
Push-Pull (10-30 V)	≥Ĺ	JR -31
Push-Pull (5 V)		.≥ 2.5
Output I		
BS 422		< 0.51
Push-Pull (5 \/)		< 0.51
Assissance Outside Land		
PS 422	<u> </u>	20 m
		: 10 mA
Alarm Output		10
RS 422	O.C. NPN	10 m/
Push-Pull (10-30 V)	O.C. NPN	10 m/
Push-Pull (5 V)	O.C. NPN	10 m/
Environmental Characteristics		
Operating Temperature Penge	-10°C to	. 7000
Storage Temperature Dance	-10 010	+700
Storage remperature harrye	-25°C to	+85
Snock Resistance	1,000 ms ⁻²	(3 ms
Mechanical Characteristics		
Shaft Diameter		5mn
Absolute Maximum Shaft Load		3 3 lbs
Absolute Maximum Speed		0 RPM
lorque	≤1 Ncm	(IP 64
Protection (DIN 40050)		IP 64
Connection	Cable axia	I/radia
Housing	Alu	minun
Flange	S = synchro flange, R = round	flange
Weight	60 g g	pprox
Bearing Life		aft load
	1 x 10 ⁹ revolutions (typ.), at 75% full rated sha	aft load
	IX IU (EVOIDHOUS HVD.), AL 75% HIII MED SIX	
	1 x 10 ⁸ revolutions (typ.), at 100% full rated sha	off load

- Encoder self tests for disk contamination, disk breakage, overtemperature, undervoltage and excessive LED aging, and provides an alarm output if these conditions occur
- Protection class IP 64
- Maximum impulse frequency 300kHz

Model BI 30

Bourns® Encoders





CONNECTION DIAGRAM

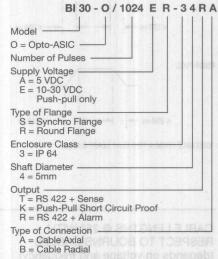
N.C. Vcc Sense ¹ 0.14 Yellow Channel A Channel A 0.14 Wh N.C. Channel A 0.14 White/ Channel B Channel B 0.14 Green/ N.C. Channel B 0.14 Green/	Push-Pull	RS 422	Lead Diameter mm ²	Color
Channel A Channel A 0.14 Wh N.C. Channel A 0.14 White/ Channel B 0.14 Green/ N.C. Channel B 0.14 Green/	VDC ± 10%/10-30 VDC	5 VDC ± 10%/10-30 VDC	0.5	Red
N.C. Channel A 0.14 White/ Channel B 0.14 Green/ N.C. Channel B 0.14 Green/	N.C.	Vcc Sense ¹	0.14	Yellow/Red
Channel B Channel B 0.14 Green/ N.C. Channel B 0.14 Green/	Channel A	Channel A	0.14	White
N.C. Channel B 0.14 Green/	N.C.	Channel A	0.14	White/Brown
	Channel B	Channel B	0.14	Green
	N.C.	Channel B	0.14	Green/Brown
Channel N Channel N 0.14 Yell	Channel N	Channel N	0.14	Yellow
N.C. Channel N 0.14 Yellow/	N.C.	Channel N	0.14	Yellow/Brown
GND GND 0.5 Bla	GND	GND	0.5	Black
Alarm Alarm/Sense GND ² 0.14 Yellow Lead Shield		Alarm/Sense GND ²	0.14	Yellow/Black

¹ Only for RS 422 + Sense (T)

TOLERANCES EXCEPT WHERE NOTED (DIN 7168):

0-6mm	±0.1
6-30mm	±0.2
30-120mm	±0.3

HOW TO ORDER



STANDARD RESOLUTIONS AVAILABLE

5	60	360	1000
10	100	400	1024
20	128	500	1250
25	200	512	1500
30	250	600	
50	256	900	

Consult factory for non-standard resolutions.

For accessories, see pages 217-223.

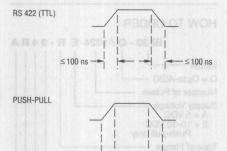
² Depends upon ordering code

Model BI 30

Bourns® Encoders

DELAY TIMES FOR 1.5M CABLE

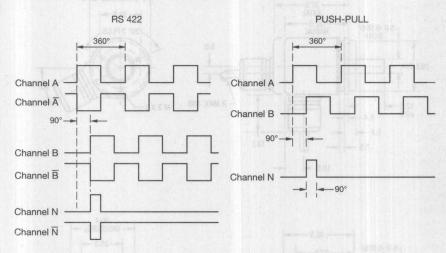
Pulse shape: Pulse duty factor: 1:1
Tolerance: ± 25° electrical



*DISTANCE FROM A TO B IS AT LEAST 0.45 µs.

OUTPUT TABLE

(Shaft turning clockwise as seen from front of encoder)

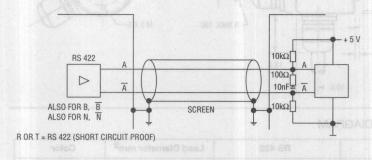


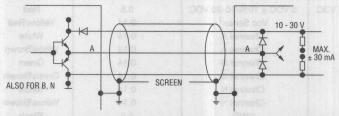
CABLE LENGTHS @ 25° WITH RESPECT TO BOURNS CABLES (depends on voltage and frequency)

LENGTH	RS 422	PUSH-PULL
10m	5 VDC, 300 kHz	12 VDC, 200 kHz 24 VDC, 200 kHz 30 VDC, 200 kHz
50m	5 VDC, 300 kHz	12 VDC, 200 kHz 24 VDC, 100 kHz 30 VDC, 50 kHz
100m	5 VDC, 300 kHz	12 VDC, 200 kHz 24 VDC, 50 kHz 30 VDC, 25kHz

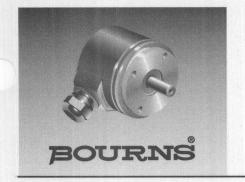
Consult factory for other lengths.

OUTPUT CIRCUIT





K = PUSH-PULL (SHORT CIRCUIT PROOF AND OVERLOAD-PROOF)



INCREMENTAL SHAFT ENCODER WITH OPTO-ASIC

- The industry standard economical encoder
- EMC class IV as per IEC 801
- To 14,400 steps at 3,600 impulses
- Short circuit proof and overload protected (10-30V)
- Synchro flange and round flange

Model BI 36

Electrical Characteristics					
Output				F	RS 422 (TTL), and Push-pull
General Design					
De 400					5 VDC
					5 VDC, 10-30 VDC
Power Consumption					40 mA (5 VDC)
RS 422					40 mA (5 VDC)
Push-Pull				30 m	A (24 VDC), 40 mA (5 VDC)
Pulse Frequency					
RS 422					300 kHz
Push-Pull	4 otrlany3 = 3				200 kHz, 300 kHz (5 V)
BS 422					≥ 2.5V
					≥ U _R -3 V
					≥ 2.5V
Output L					many in souther.
RS 422					≤ 0.5 V
Push-Pull (10-30 V)					≤2 V
Push-Pull (5 V)	MANAGER & X				≤ 0.5 V
Maximum Output Load					
BS 422	PERMOVERUE				#901038/4/400 ±20 mA
					±30 mA
					±10 mA
Alarm Output	ist since it is it				
Alam Output					O.C. NPN 10 mA
					O.C. NPN 10 mA
Push-Pull (5 V)					O.C. NPN 10 mA
	tics				
Environmental Characterist					1000 +7000
Operating Temperature Rang	je				-25°C to +85°C
Operating Temperature Rang Storage Temperature Range.	je				25°C to +85°C
Operating Temperature Rang Storage Temperature Range. Vibration Proof	je				100 ms ⁻² (10-2000 Hz)
Operating Temperature Rang Storage Temperature Range.	je				100 ms ⁻² (10-2000 Hz)
Operating Temperature Rang Storage Temperature Range. Vibration ProofShock Resistance	je				25°C to +85°C 100 ms ⁻² (10-2000 Hz) 1,000 ms ⁻² (3 ms)
Operating Temperature Rang Storage Temperature Range. Vibration Proof Shock Resistance	s				-25°C to +85°C 100 ms ⁻² (10-2000 Hz) 1,000 ms ⁻² (3 ms) 6mm, 6.35mm
Operating Temperature Rang Storage Temperature Range. Vibration Proof Shock Resistance	s				-25°C to +85°C 100 ms ⁻² (10-2000 Hz) 1,000 ms ⁻² (3 ms) 6mm, 6.35mm
Operating Temperature Rang Storage Temperature Range. Vibration Proof Shock Resistance	s ad				-25°C to +85°C 100 ms ⁻² (10-2000 Hz) 1,000 ms ⁻² (3 ms) 6mm, 6.35mm 6.5 lbs.), axial 15 N (3.3 lbs)
Operating Temperature Rang Storage Temperature Range. Vibration ProofShock Resistance	s ad		Surgering Append	Radial 30 N (
Operating Temperature Range Storage Temperature Range. Vibration Proof	s ad	N N		Radial 30 N (-25°C to +85°C
Operating Temperature Range Storage Temperature Range. Vibration Proof	s ad			Radial 30 N (-25°C to +85°C 100 ms ⁻² (10-2000 Hz) 1,000 ms ⁻² (3 ms) 6mm, 6.35mm 6.5 lbs.), axial 15 N (3.3 lbs) Max, 10,000 RPM ≤ 1 Ncm (IP 64)
Operating Temperature Rang Storage Temperature Range. Vibration Proof	s ad			Radial 30 N (i	-25°C to +85°C100 ms ⁻² (10-2000 Hz)1,000 ms ⁻² (3 ms)
Operating Temperature Rang Storage Temperature Range. Vibration Proof	s ad			Radial 30 N (i	-25°C to +85°C
Operating Temperature Rang Storage Temperature Range. Vibration Proof Shock Resistance	s ad				-25°C to +85°C100 ms ⁻² (10-2000 Hz)
Operating Temperature Rang Storage Temperature Range. Vibration Proof Shock Resistance	s ad				-25°C to +85°C100 ms ⁻² (10-2000 Hz)
Operating Temperature Rang Storage Temperature Range. Vibration Proof Shock Resistance	s ad			Radial 30 N (i	-25°C to +85°C
Operating Temperature Rang Storage Temperature Range. Vibration Proof	s ad			Radial 30 N (i	-25°C to +85°C
Operating Temperature Rang Storage Temperature Range. Vibration Proof Shock Resistance	s ad		1 x		25°C to +85°C100 ms ⁻² (10-2000 Hz)

Synchro flange and round flange

Model BI 36

Bourns® Encoders

CONNECTION DIAGRAM

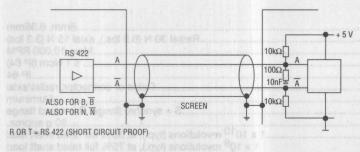
Push-Pull	RS 422	Lead Diameter mm ²	Color
5 VDC ± 10%/10-30 VDC	5 VDC ± 10%	0.5	Red
N.C.	Vcc Sense ¹	0.14	Yellow/Red
Channel A	Channel A	0.14	White
CICTY = N.C.	Channel A	0.14	White/Brown
Channel B	Channel B	0.14	Green
N.C.	Channel B	0.14	Green/Brown
Channel N	Channel N	0.14	Yellow
N.C.	Channel N	0.14	Yellow/Brown
GND	GND	0.5	Black
Alarm	Alarm/Sense GND ²	0.14	Yellow/Black
Lead Shield			

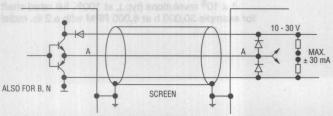
¹ Only for RS 422 + Sense (T)

6 POLE CONNECTOR (FLANGE CONNECTOR)

Push-Pull	Pin
5 VDC ± 10%/10-30 VDC	1
Channel A	2
Channel N	3
Channel B	4
Alarm	5
GND	6

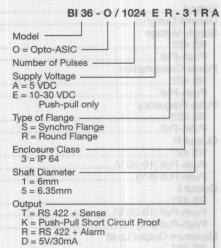
OUTPUT CIRCUIT





K = PUSH-PULL (SHORT CIRCUIT PROOF AND OVERLOAD-PROOF)

HOW TO ORDER



Type of Connection A = Cable Axial B = Cable Radial

N = 6 pole, binder plug, axial (push-pull only) J = 6 pole, binder plug, radial (push-pull only)

STANDARD RESOLUTIONS **AVAILABLE**

10	60	256	900	2500
20	72	360	1000	3600
25	100	400	1024	
28	128	500	1250	
32	200	512	2000	
50	250	600	2048	

Consult factory for non-standard resolutions.

CABLE LENGTHS @ 25° WITH RESPECT TO BOURNS CABLES (depends on voltage and frequency)

LENGTH	RS 422	PUSH-PULL
10m	5 VDC, 300 kHz	12 VDC, 200 kHz 24 VDC, 200 kHz 30 VDC, 200 kHz
50m	5 VDC, 300 kHz	12 VDC, 200 kHz 24 VDC, 150 kHz 30 VDC, 75 kHz

Consult factory for other lengths.

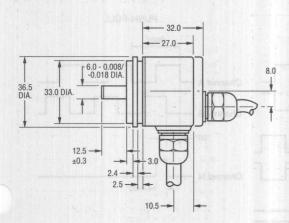
For accessories, see pages 217-223.

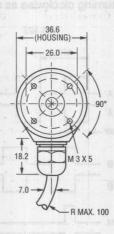
² Depends upon ordering code

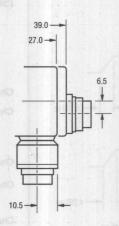
Model BI 36

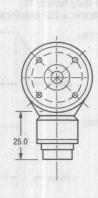
Bourns® Encoders

Dimensional Drawings

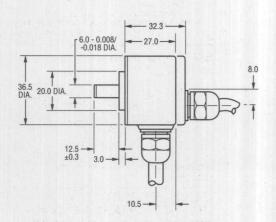


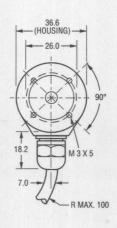


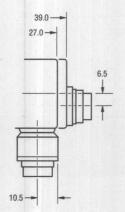


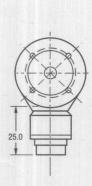


Model BI 36









TOLERANCES EXCEPT WHERE NOTED (DIN 7168):

0-6mm

+0.1

6-30mm ±0.2

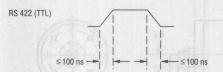
30-120mm ±0.3

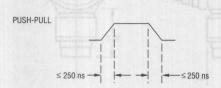
Model BI 36

Bourns® Encoders

DELAY TIMES FOR 1.5M CABLE

Pulse shape: T Pulse duty factor: 1:1 Tolerance: ± 25° electrical

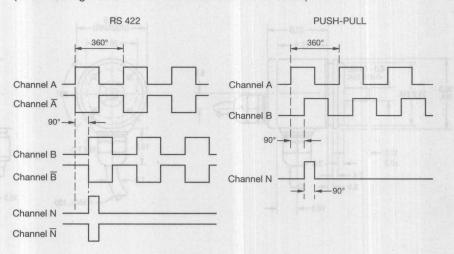


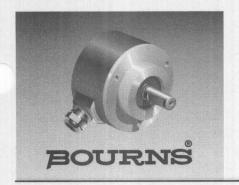


*DISTANCE FROM A TO B IS AT LEAST 0.45 μs .

OUTPUT TABLE

(Shaft turning clockwise as seen from front of encoder)





INCREMENTAL SHAFT ENCODER WITH OPTO-ASIC

- Up to 40,000 steps at 10,000 impulses
- Short-circuit and overload protection (10-30V)
- Maximum pulse frequency 300 kHz
- Synchro, square or clamping flange
- Enclosure class IP 65

Model BI 58

Electrical Characteristics	
Output	RS 422 (TTL), Push-pull, Push-pull complementary
Supply Voltage	(0MS10H)
RS 422	
Power Consumption	1
Maximum Pulse Frequency	00 117 (24 400), 00 117 (10 400
DC 400	
Output - H	3 전 3 전 5명 (1) [1] 12 전 1 대 [12] [2] 1 전 1 대 [12] 1 전 1 전 2 대 [12] 1 전 2
	≥ 2.5 \
	≥2.5 \
Push-Pull 10-30 V	U _B - 3 \
	U _B - 3 \
Output - L	
RS 422	≤0.5 \
	≤ 0.5 \
	<2\
	≤2\
Maximum Output Load	
	±20 mA/channe
	±20 mA/channe
	±30 mA/channe
	±30 mA/channe
Alarm Output	O.C. NPN 10 mA
Environmental Characteristics	
Operating Temperature Range	10°C to +70°C
	-25°C to +85°C
Chack Posistones (IEC 69 2 27)	1,000 ms ⁻² (3 ms
SHOCK RESISTANCE (IEC 08-2-27)	1,000 HIS - (3 HIS
Mechanical Characteristics	
Shaft Diameter	
Absolute Maximum Shaft Load	
10mm Dia./9.52mm Dia	
	Radial 110 N (24 lbs.), axial 60 N (13 lbs.
	10,000 rpn
	≤1 Ncm (IP 64
	14 gcm ² approx
	As per DIN VDE 0160
	Aluminum 58mm dia
	S = synchro flange, K = clamping flange, Q = square flange, M = synchro flange (63.5mm
Weight	
Bearing Life	
1. 2 32 1 2 24 1 Sunt days (v 2) 923 29 1	1 X 10° revolutions (typ.) at 75% of full rated shaft load
	1 X 10 ⁸ revolutions (typ.) at 100% of full rated shaft load
	For example, 30,000 h at 6,000 RPM with a 13 lb. radial load (10mm or 9.52 mm shaft
*Other specifications available on request	. S. Shample, es, est in all share in the list taken load (1011111 of 5.52 11111 share

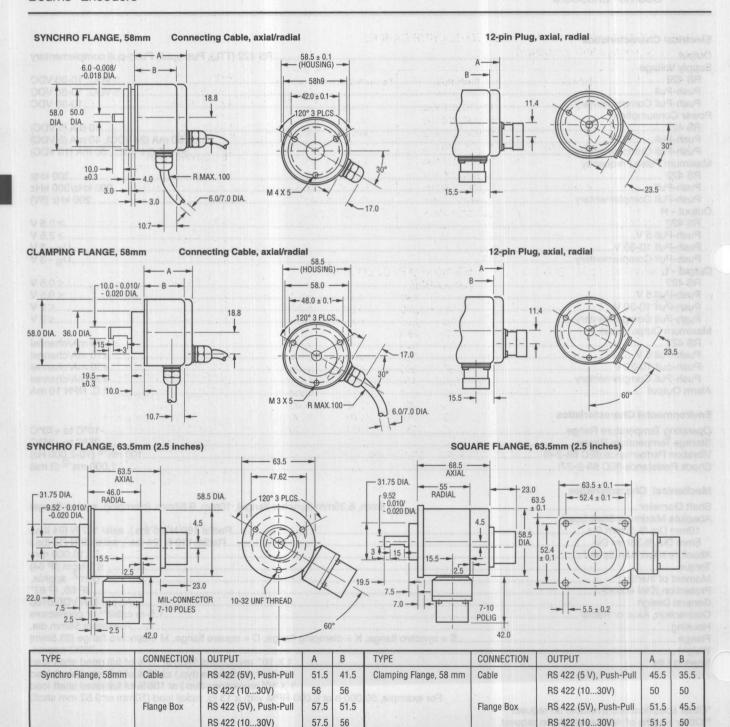
^{*}Other specifications available on request

^{**}Other lengths of lead available on request

INCREMENTAL SHAFT ENCODER WITH

- RS 422
- Push-pull complementary
- Encoder monitoring/alarm output
- EMC: class IV as per IEC 801

Model BI 58



Model BI 58

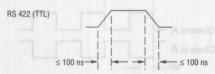
Bourns® Encoders

CABLE LENGTHS @ 25° WITH RESPECT TO BOURNS CABLES (depends on voltage and frequency)

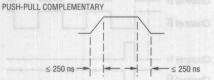
Length	RS 422	Push-Pull	Push-Pull Complementary
10m	5 VDC, 300 kHz	12 VDC, 200 kHz	12 VDC, 200 kHz
		24 VDC, 200 kHz	24 VDC, 200 kHz
		30 VDC, 200 kHz	30 VDC, 200 kHz
50m	5 VDC, 300 kHz	12 VDC, 200 kHz	12 VDC, 200 kHz
		24 VDC, 175 kHz	24 VDC, 50 kHz
		30 VDC, 100 kHz	30 VDC, 25 kHz
100m	5 VDC, 300 kHz	12 VDC, 200 kHz	12 VDC, 150 kHz
		24 VDC, 75 kHz	24 VDC, 25 kHz
		30 VDC, 50 kHz	30 VDC, 12 kHz

DELAY TIMES FOR 1.5M LEAD

Pulse shape: \(\square\) Pulse duty factor: 1:1 Tolerance: ± 25° electrical



PUSH-PULL



*DISTANCE FROM A TO B IS AT LEAST 0.45 µs

SHORT CIRCUIT AND OVERLOAD PROOF OVER THE WHOLE TEMPERATURE RANGE. POLARITY PROTECTION.

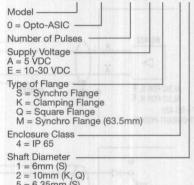
STANDARD RESOLUTIONS AVAII ARI F

VAVIEV			
5	180	500	1600
10	200	512	1800
20	226	600	1885
25	250	635	2000
30	256	720	2048
50	280	750	2500
60	300	900	3600
100	314	1000	3925
120	360	1024	4096
125	400	1250	5000
128	460	1270	9000
150	480	1500	10000

Consult factory for non-standard resolutions.

HOW TO ORDER

BI 58 - 0 / 1000 E S - 4 1 K B



5 = 6.35mm (S) 6 = 9.52mm (K, Q, M)

Output

T = RS 422 (TTL)¹ + sense
K = Push-pull, short circuit proof
I = Push-pull² complementary
R = RS 422 + Alarm
D = 5V/30 mA

Type of Connection

A = Cable Axial B = Cable Radial

C = Conin-plug, axial right-turning D = Conin-plug, radial right-turning G = Conin-plug, axial left-turning

H = Conin-plug, radial left-turning O = MIL MS Conn., 10 pin, axial³

K = MIL MS Conn., 10 pin, radial³ P = MIL MS Conn., 7 pin, axial⁴ L = MIL MS Conn., 7 pin, radial⁴

M = MIL MS Conn., 6 pin, axial⁴

Q = MIL MS Conn., 6 pin, radial⁴ R = MIL MS Conn., 10 pin, axial⁵ T = MIL MS Conn., 10 pin, radial⁵

¹ Only with 5 VDC

² Only with 10-30 VDC

³ Euro pinout; not with RS 422 + sense

⁴ Only with push-pull

⁵ U.S. pinout; not with RS 422 + sense

TOLERANCES EXCEPT WHERE NOTED (DIN 7168):

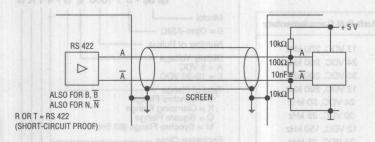
0-6mm ±0.1 6-30mm ±0.2 30-120mm ±0.3

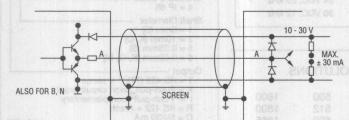
For accessories, see pages 217-223.

Model BI 58

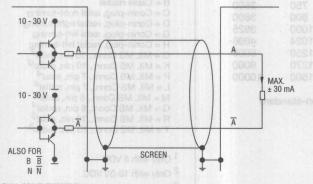
Bourns® Encoders

OUTPUT CIRCUIT 99090 OF WOM





K = PUSH-PULL (SHORT CIRCUIT PROOF AND OVERLOAD-PROOF)



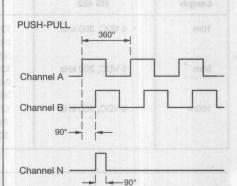
I = PUSH-PULL COMPLEMENTARY (SHORT CIRCUIT PROOF AND OVERLOAD-PROOF)

OUTPUT TABLE (Shaft turning clockwise as seen from

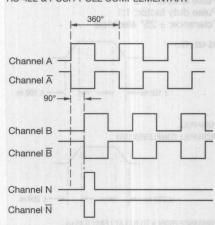
TO BOURNS CABLES

(Shaft turning clockwise as seen from front of encoder)

Model BI 58



RS-422 & PUSH-PULL COMPLEMENTARY



INCREMENTAL HOLLOW SHAFT ENCODER

Short-circuit and overload protected over the whole temperature range

■ Up to 20,000 staps at 5,000 impulses/revolution

Encoder self test with alarm output
 IP 65 environmental protection

Model BI 58

Bourns® Encoders

CONNECTION CABLE

CABLE PVC COLOR	CABLE PUR COLOR	RS 422 + SENSE (T)	OUTPUT RS 422 + ALARM (R)	PUSH-PULL (K)	PUSH-PULL COMP. (I)
Red	Brown/Green	5 VDC = ±10%	5/10-30 VDC =	5/10-30 VDC =	10-30 VDC =
Yellow/Red	Blue	Sense Vcc ²	Sense Vcc	Alarm ⁴	Sense Vcc
White	Brown	Channel A	Channel A	Channel A	ChannelA
White/Brown	Green	Channel A	Channel A	N.C.	Channel A
Green	Gray	Channel B	Channel B	Channel B	Channel B
Green/Brown	Pink	Channel B	Channel B	N.C.	Channel B
Yellow	Red	Channel N	Channel N	Channel N	Channel N
Yellow/Brown	Black	Channel N	Channel N	N.C.	Channel N
Black	White/Green	GND	GND	GND	GND
Yellow/Black Screen ³	Violet (white) ¹ Screen ³	Sense GND Screen ³	Alarm Screen ³	Alarm⁴ Screen ³	Alarm Screen ³

¹ White for RS 422 + sense (T)

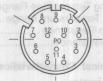
12 POLE CONNECTOR

PIN	RS 422 + SENSE (T)	RS 422 + ALARM (R)	PUSH-PULL (K)	PUSH-PULL COMP. (I)
enterov	Channel B	Channel B	N.C.	Channel B
2	Sense Vcc ⁵	Sense Vcc	N.C.	Sense Vcc
3	Channel N	Channel N	Channel N	Channel N
4	Channel N	Channel N	N.C.	Channel N
5	Channel A	Channel A	Channel A	Channel A
6	Channel A	Channel A	N.C.	Channel A
7	N.C.	Alarm	Alarm	Alarm
8	Channel B	Channel B	Channel B	Channel B
9	N.C.	N.C.	N.C.	N.C.
10	GND	GND	GND	GND
11	Sense GND	N.C.	N.C.	N.C.
12	5 VDC = ± 10%	5/10-30 VDC =	5/10-30 VDC =	10-30 VDC =

⁵ Do not connect to pin 12



PIN ASSIGNMENT FLANGE BOX LEFT-TURNING



FLANGE BOX RIGHT-TURNING

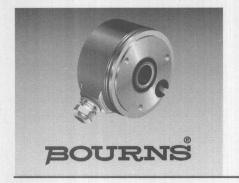
MIL CONNECTOR

510 GI	10 POLES	10 POLES	6 POLES	7 POLES
PIN	RS 422/EURO-PINOUT (CONNECTOR CODES 0 AND K)	RS 422/U.SPINOUT (CONNECTOR CODES R AND T)	PUSH-PULL	PUSH-PULL
1/A	Channel A	Channel A	5 VDC ± 10%/10-30 VDC	Channel A
2/B	Channel B	Channel B	Channel A	Channel B
3/C	Channel N	Channel N	Channel B	Channel N
4/D	5 VDC = ±10%/10-30 VDC	5 VDC = ±10%/10-30 VDC =	Channel N	5 VDC ±10%/10-30 VDC
5/E	Alarm	Alarm	GND	Alarm
6/F	GND	GND	Screen	GND
7/G	Channel A	Screen		Screen
8/H	Channel B	Channel A		
9/1	Channel N	Channel B		
10/J	Screen	Channel N		

² Do not connect with red (PVC) or brown/green (PUR)

³ Connected to the housing

⁴ When cable is PVC use either yellow/red or yellow/black; only use violet when cable is TPE



INCREMENTAL HOLLOW SHAFT ENCODER

- Mounting length only 33mm
- Optical measuring principle
- Up to 20,000 steps at 5,000 impulses/revolution
- Short-circuit and overload protected over the whole temperature range
- Encoder self test with alarm output
- IP 65 environmental protection

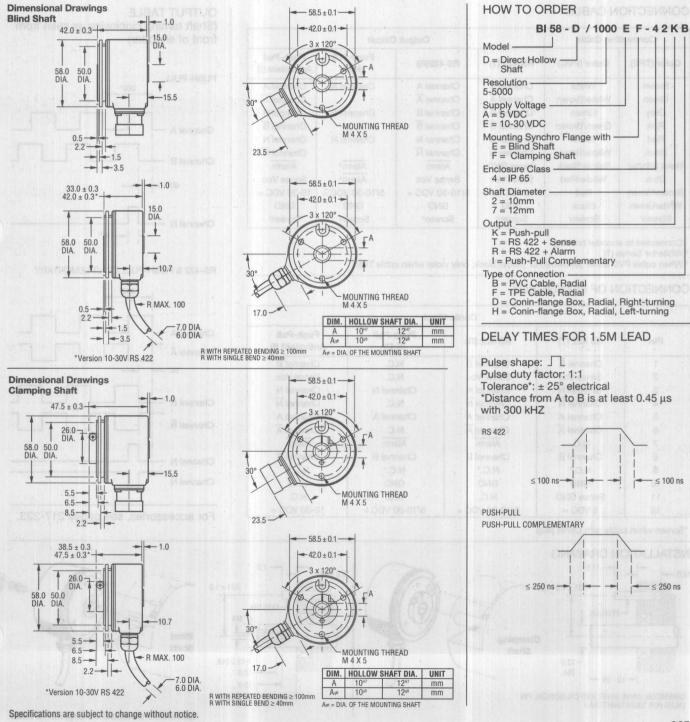
Model BI 58-D

Output			RS 42	2 (TTL), Push-pull, Push-pull complementary
Supply Voltage		DATED		
RS 422	ILHA-HSLIS DID M	9A.15 = 555 831	maeves - stalen	5 VDC, 10-30 VDC
				10-30 VDC
				10-30 VDC
BS 422			A IDTH BING	40 mA (5 VDC
Push-Pull		1 10111 101110		60 mA (10 VDC
				30 mA (24 VDC
Maximum Dulas Examinant				
BS 422				300 kH
				200 kH
Output H		masiA		Facility salary see 15 years
PS 422				≥2.5 VD0
Push-Pull 10 30 V				≥U _B - 3 VD0
				≥0B - 3 VD0
DS 422				≤0.5 VD0
Puch Pull Complementary 10, 20 V	••••••			
Maximum Output Load				20 mA/channe
				30 mA/channe
				30 mA/channe
Alarm Output			******************************	
Short-Circuit and Overload Protection		DO	100 D D. II 40	00 V I D D. O 10 00
Deverse Delevity Dustration		RS 4	22, Push-Pull 10	30 V and Push-Pull Complementary 1030\
Reverse Polarity Protection			22, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\
Reverse Polarity Protection	Ohanna X	TO IN	22, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\
Reverse Polarity Protection	A torrestO	N.CJ. N.CJ.	I22, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\
Reverse Polarity Protection Environmental Characteristics Operating Temperature Range (at Shaft	A lore and o	N.C. Alarm	I22, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\
Reverse Polarity Protection Environmental Characteristics Operating Temperature Range (at Shaft Storage Temperature Range	A menado masiA	N.C. Namn	122, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C
Reverse Polarity Protection Environmental Characteristics Operating Temperature Range (at Shaft Storage Temperature Range Vibration Resistance	i) A normal Control of the Control o	N.C. Alarm	122, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6
Reverse Polarity Protection Environmental Characteristics Operating Temperature Range (at Shaft Storage Temperature Range	i) A normal Control of the Control o	N.C. Alarm	122, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6
Environmental Characteristics Operating Temperature Range (at Shaft Storage Temperature Range	t) A serverito instala	N.C. Mem.	122, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27
Environmental Characteristics Operating Temperature Range (at Shaft Storage Temperature Range	t) A company mask and a company company and a company an	D. M. C. Marin M. C. M.	122, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27
Environmental Characteristics Operating Temperature Range (at Shaft Storage Temperature Range	t) A company mask and a company company and a company an	D. M. C. Marin M. C. M.	122, Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27
Environmental Characteristics Operating Temperature Range (at Shaft Storage Temperature Range	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 Push-Pull 10	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27
Reverse Polarity Protection	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 nting shaft dimens nting shaft dimens	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27
Reverse Polarity Protection Environmental Characteristics Operating Temperature Range (at Shaff Storage Temperature Range Vibration Resistance Shock Resistance Mechanical Characteristics Shaft Diameter Absolute Maximum Speed	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 nting shaft dimens	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27100mm, tolerance g³ (-0.005 0.027mm ion 12mm, tolerance g³ (-0.006 0.033mm
Reverse Polarity Protection Environmental Characteristics Operating Temperature Range (at Shaff Storage Temperature Range Vibration Resistance Shock Resistance Mechanical Characteristics Shaft Diameter Absolute Maximum Speed	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 nting shaft dimens	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27 ion 10mm, tolerance g³ (-0.005 0.027mm ion 12mm, tolerance g³ (-0.006 0.033mm6,000 rpn≤1 Ncm (IP 65
Reverse Polarity Protection	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 nting shaft dimens	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-2710m, tolerance g³ (-0.005 0.027mm ion 12mm, tolerance g³ (-0.006 0.033mm
Reverse Polarity Protection	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 nting shaft dimens	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-2710m, tolerance g³ (-0.005 0.027mm ion 12mm, tolerance g³ (-0.006 0.033mm
Reverse Polarity Protection	t)	with required mou	nting shaft dimens	30 V and Push-Pull Complementary 1030\\ 30 V and Push-Pull Complementary 1030\\10°C to +70°C \\25°C to +85°C \\10g = 100 m/s² (102 kHz) (IEC 68-2-27 \\100g = 1000 m/s² (3 ms) (IEC 68-2-27 \\100mm, tolerance g³ (-0.005 0.027mm \\6,000 rpn \\6,000 rpn \\51 Ncm (IP 65 \\
Reverse Polarity Protection	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 Push-Pull 10 nting shaft dimens nting shaft dimens	30 V and Push-Pull Complementary 1030' 30 V and Push-Pull Complementary 1030'
Reverse Polarity Protection	i)	with required mou	I22, Push-Pull 10 Push-Pull 10 nting shaft dimens	30 V and Push-Pull Complementary 1030' 30 V and Push-Pull Complementary 1030'
Reverse Polarity Protection	t)	with required mou	I22, Push-Pull 10 Push-Pull 10 nting shaft dimens	30 V and Push-Pull Complementary 1030\\ 30 V and Push-Pull Complementary 1030\\
Reverse Polarity Protection	t)	with required mou	nting shaft dimens	30 V and Push-Pull Complementary 1030\ 30 V and Push-Pull Complementary 1030\10°C to +70°C25°C to +85°C10g = 100 m/s² (102 kHz) (IEC 68-2-6100g = 1000 m/s² (3 ms) (IEC 68-2-27

^{*}Other specifications available on request

^{**}Other lengths of lead available on request

Model BI 58-D



Model BI 58-D

Bourns® Encoders

CONNECTION CABLE

Connection Cable		Output Circuit				
Color (TPE)	Color (PVC)	RS 422 (T)	RS 422(R)	Push-Pull (K,D)	Push-Pull Antivalent (I)	
Brown	White	Channel A	Channel A	Channel A	Channel A	
Green	White/Brown	Channel A	Channel A		Channel A	
Grey	Green	Channel B	Channel B	Channel B	Channel B	
Pink	Green/Brown	Channel B	Channel B	ALT OKINGSHIP	Channel B	
Red	Yellow	Channel N	Channel N	Channel N	Channel N	
Black	Yellow/Brown	Channel N	Channel N		Channel N	
Violet (White)2	Yellow/Black	Sense GND	Alarm	Alarm ³	Alarm	
Blue	Yellow/Red	Sense Vcc	Sense Vcc	Alarm ³	Sense Vcc	
Brown/Green	Red	5 VDC =	5/10-30 VDC =	5/10-30 VDC =	10-30 VDC =	
White/Green	Black	GND	GND	GND	GND	
Screen ¹	Screen ¹	Screen1	Screen ¹	Screen ¹	Screen ¹	

¹ Connected to encoder housing

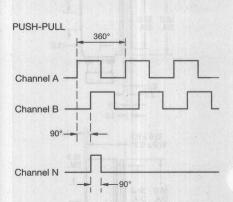
² White for Sense (T) ³ When cable PVC either yellow/red or yellow/black; only violet when cable TPE

CONNECTION OF FLANGE BOX

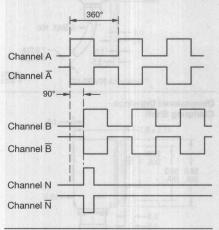
Conin 12pol.						
Pin	RS 422 (T)	RS 422 (R)	Push-Pull (K,D)	Push-Pull Antivalent (I)		
1	Channel B	Channel B	N.C.	Channel B		
2	Sense Vcc	Sense Vcc	N.C.	Sense Vcc		
3	Channel N	Channel N	Channel N	Channel N		
4	Channel N	Channel N	N.C.	Channel N		
5	Channel A	Channel A	Channel A	Channel A		
6	Channel A	Channel A	N.C.	Channel A		
7	N.C.	Alarm	Alarm	Alarm		
8	Channel B	Channel B	Channel B	Channel B		
9	N.C.*	N.C.*	N.C.*	N.C.*		
10	GND	GND	GND	GND		
11	Sense GND	N.C.	N.C.	N.C.		
12	5 VDC =	5/10-30 VDC =	5/10-30 VDC =	10-30 VDC =		

*Screen when cable with Conin plug

OUTPUT TABLE (Shaft turning clockwise as seen from front of encoder)

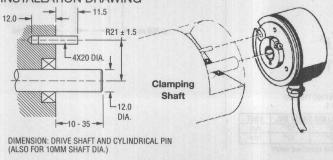


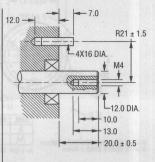
RS-422 & PUSH-PULL COMPLEMENTARY

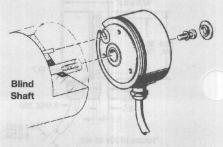


For accessories, see pages 217-223.

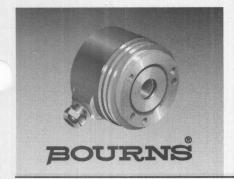








Specifications are subject to change without notice.



INCREMENTAL HOLLOW SHAFT ENCODER

Model BI 58-H

- Hollow shaft
- Optical measuring principle
- Short circuit and overload protection
- Encoder self test with alarm circuit
- Protection class IP 64

Model BI 58-H

Operating Temperature Range (at Shaft) -10°C to +70°C Storage Temperature Range -25°C to +85°C Vibration Resistance 10g = 100 m/s² (102 kHz) Shock Resistance 100g = 1000 m/s² (3 ms)	Electrical Characteristics	Syntano Rahaio
Supply Voltage	Output	RS 422 (TTL), Push-pull, Push-pull complementary
Sy 222	Supply Voltage	[사용물 공기 발생 : 18명 시간 18명 시 전 18명 . [1] [1] [1] [1] [1] [1] [1] [1] [1] [1]
Push-Pull Complementary	BS 422	5 VDC, 10-30 VDC
Push-Pull Complementary 10-30 VDC		
Power Consumption		
RS 422	Power Consumption	
Push-Pull Complementary	RS 422	40 mA (5 VDC)
Push-Pull Complementary 30 mA (24 VDC)		
Maximum Pulse Frequency 300 kHz RS 422 200 kHz Push-Pull 200 kHz Output H ≥20 kHz Ustput H ≥25 VDC RS 422 ≥25 VDC Push-Pull 1030 V ≥UB - 3 VDC Output L SUB - 3 VDC Ustput L SUB - 3 VDC Push-Pull Complementary 1030 V ≥2 VDC Push-Pull 1030 V ≥2 VDC Push-Pull Complementary 1030 V ≥2 VDC Alarm Output Storage Total Value (Complementary 1030 V) Reverse Polarity Protection Push-Pull 1030 V and Push-Pull Complementary 1030V Reverse Polarity Protection Push-Pull 1030 V and Push-Pull Complementary 1030V Reverse Polarity Protection Push-Pull 1030 V and Push-Pull Complementary 1030V Environmental Characteristics -10°C to +70°C Storage Temperature Range (at Shaft) -25°C to +85°C Vibration Resistance 10g = 100 m/s² (3 ms) Shock Resistance 10g = 100 m/s² (102 kHz) Shock Resistance 100 g = 1000 m/s² (3 ms) Mechanical Characteristics 10m hollow shaft with required mounting shaft dimension 10mm, tolerance g² (-0.005 0.027mm) <td></td> <td></td>		
RS 422		
Push-Pull .200 kHz 20utput H .200 kHz Push-Pull Complementary .25 VDC Push-Pull 1030 V .2Ug - 3 VDC 20utput L .200 kHz RS 422 .20.5 VDC Push-Pull Complementary 1030 V .20 kJ Abort-Circuit and Overload Protection .9ush-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030 V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull C	De 400	300 647
Push-Pull Complementary		
Output H ≥2.5 VDC RS 422 ≥0.5 VDC Push-Pull Complementary 1030 V ≥0.9 - 3 VDC Output L State 2 Push-Pull T030 V ≥2 VDC Push-Pull Complementary 1030 V ≥2 VDC Alarm Output O.C. NPN 10 mA; ≤0.5 V Short-Circuit and Overload Protection Push-Pull 1030 V and Push-Pull Complementary 1030V Reverse Polarity Protection Push-Pull 1030 V and Push-Pull Complementary 1030V Environmental Characteristics Push-Pull 1030 V and Push-Pull Complementary 1030V Storage Temperature Range (at Shaft) -10°C to +70°C Storage Temperature Range (at Shaft) -25°C to +85°C Vibration Resistance 10g = 100 m/s² (102 kHz) Shock Resistance 10g = 1000 m/s² (3 ms) Mechanical Characteristics 10g = 1000 m/s² (3 ms) Mechanical Characteristics 10g = 1000 m/s² (3 ms) Shaft Diameter 10mm hollow shaft with required mounting shaft dimension 10mm, tolerance g² (-0.005 0.027mm) Tolerances 12mm hollow shaft with required mounting shaft dimension 12mm, tolerance g² (-0.006 0.033mm) Tolerances 20mm hollow shaft with required		
R\$ 422		200 KHZ
Push-Pull 1030 V. ≥UB - 3 VDC Push-Pull Complementary 1030 V ≥UB - 3 VDC Output L S0.5 VDC RS 422 ≤0.5 VDC Push-Pull Complementary 1030 V ≤2 VDC Alarm Output O.C. NPN 10 mA, ≤ 0.5 VDC Foot-Circuit and Overload Protection Push-Pull 1030 V and Push-Pull Complementary 1030V Reverse Polarity Protection Push-Pull 1030 V and Push-Pull Complementary 1030V Environmental Characteristics Push-Pull 1030 V and Push-Pull Complementary 1030V Environmental Characteristics -10°C to +70°C Storage Temperature Range (at Shaft) -25°C to +85°C Vibration Resistance 10g = 1000 m/s² (102 kHz) Shock Resistance 10g = 1000 m/s² (102 kHz) Shock Resistance 100g = 1000 m/s² (3 ms) Mechanical Characteristics 10mm hollow shaft with required mounting shaft dimension 10mm, tolerance g³ (-0.005 0.027mm) Tolerances -100g = 1000 m/s² (3 ms) Axial Offset -100g = 1000 m/s² (3 ms) Axial Offset -100g = 1000 m/s² (10 + 1000 m) Axial Offset -100g = 1000 m/s² (10 + 1000 m) Axial Offset -10.033m	Output H	
Push-Pull Complementary 1030 V		
Output L 20.5 VDC RS 422 ≤2 VDC Push-Pull Complementary 1030 V ≤2 VDC Alarm Output .0.C. NPN 10 mA, ≤0.5 V Short-Circuit and Overload Protection .Push-Pull 1030 V and Push-Pull Complementary 1030V Reverse Polarity Protection .Push-Pull 1030 V and Push-Pull Complementary 1030V Environmental Characteristics .Push-Pull 1030 V and Push-Pull Complementary 1030V Environmental Characteristics 10°C to +70°C Storage Temperature Range (at Shaft) 25°C to +85°C Vibration Resistance .10g = 100 m/s² (02 kHz) Shock Resistance .10g = 100 m/s² (3 ms) Mechanical Characteristics Shaft Diameter .10g = 100 m/s² (3 ms) Mechanical Characteristics Shaft Diameter .10mm hollow shaft with required mounting shaft dimension 10mm, tolerance g³ (-0.005 0.027mm) Tolerances Axial Offset ±0.4mm Axial Offset ±0.4mm Arguer Offset ±0.4mm Arguer Offset .1° Absolute Maximum Speed .3,000 rpm Torque .2 Ncm (IP 64) Moment		
R\$ 422		
Push-Pull 10. 30 V	Output L	A 2 10 1 4 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Push-Pull Complementary 1030 V		
Alarm Output		
Short-Circuit and Overload Protection		
Push-Pull 1030 V and Push-Pull Complementary 1030 V Push-Pull Complementary 1030 V Push-Pull Complementary 1030 V Push-Pull 1030 V Push-Pull Complementary 1030 V Push-Pull Complementary 1030 V Push-Pull 1030 V Push-Pull Complementary 1030 V Push-Pull 1030 V	Alarm Output	O.C. NPN 10 mA, ≤ 0.5 V
Comparison Com		Push-Pull 1030 V and Push-Pull Complementary 1030V
Storage Temperature Range	Environmental Characteristics	
Storage Temperature Range	Operating Temperature Range (at Sha	aft)10°C to +70°C
Vibration Resistance .10g = 100 m/s² (102 kHz) Shock Resistance .100g = 1000 m/s² (3 ms) Mechanical Characteristics	Storage Temperature Range	-25°C to +85°C
Shock Resistance 100g = 1000 m/s² (3 ms) Mechanical Characteristics Shaft Diameter 10mm hollow shaft with required mounting shaft dimension 10mm, tolerance g³ (-0.005 0.027mm) 12mm hollow shaft with required mounting shaft dimension 12mm, tolerance g³ (-0.006 0.033mm) Tolerances Axial Offset Axial Offset ±0.4mm Parallel Offset 0.4mm Angular Offset 1° Absolute Maximum Speed 3,000 rpm Torque 2 Ncm (IP 64) Moment of Inertia 65 gcm² (10mm shaft), 95 gcm² (12mm shaft) Protection (DIN 40050) IP 64* General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange		
Mechanical Characteristics Shaft Diameter		
Shaft Diameter	0008 4501 008 - 1	
Shaft Diameter	Mechanical Characteristics	
12mm hollow shaft with required mounting shaft dimension 12mm, tolerance gs (-0.006 0.033mm) Tolerances	Shoft Diameter	10mm bellow shoft with required mounting shoft dimension 10mm televance of (0.005 0.007mm)
Tolerances Axial Offset ±0.4mm Parallel Offset 0.4mm Angular Offset 1° Absolute Maximum Speed 2 Ncm (IP 64) Moment of Inertia 2 Ncm (IP 64) Protection (DIN 40050) IP 64* General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange	Shart Diarrieter	10 mm hollow shaft with required mounting shaft dimension 10 mm, tolerance g (0.005 0.027mm)
Axial Offset ±0.4mm Parallel Offset 0.4mm Angular Offset 1° Absolute Maximum Speed 3,000 rpm Torque 2 Ncm (IP 64) Moment of Inertia 65 gcm² (10mm shaft), 95 gcm² (12mm shaft) Protection (DIN 40050) IP 64* General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange	Talaura - bashneta-non not vnotnet st	12mm hollow shart with required mounting shart dimension 12mm, tolerance g° (-0.006 0.003mm)
Parallel Offset 0.4mm Angular Offset 1° Absolute Maximum Speed 3,000 rpm Torque 2 Ncm (IP 64) Moment of Inertia 65 gcm² (10mm shaft), 95 gcm² (12mm shaft) Protection (DIN 40050) IP 64* General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange	Tolerances	DISSECTION SANCTIONS CONTRACTOR C
Angular Offset 1° Absolute Maximum Speed 3,000 rpm Torque 2 Ncm (IP 64) Moment of Inertia 65 gcm² (10mm shaft), 95 gcm² (12mm shaft) Protection (DIN 40050) IP 64* General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange		
Absolute Maximum Speed		
Torque 2 Ncm (IP 64) Moment of Inertia 65 gcm² (10mm shaft), 95 gcm² (12mm shaft) Protection (DIN 40050) IP 64° General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange		
Moment of Inertia	Absolute Maximum Speed	3,000 rpm
Protection (DIN 40050) IP 64* General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange	Torque	2 Ncm (IP 64)
General Design As per DIN VDE 0160 Radial Connection 1.5-m cable** Housing Aluminum Flange Synchro flange		
Radial Connection	Protection (DIN 40050)	
HousingAluminum FlangeSynchro flange		
HousingAluminum FlangeSynchro flange	Radial Connection	
	Housing	
Weight	Flange	Synchro flange
	Weight	210g approx

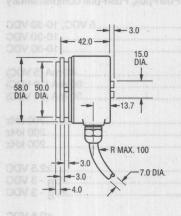
^{*}Other specifications available on request

^{**}Other lengths of lead available on request

Model BI 58-H

Bourns® Encoders

Dimensional Drawings Synchro Flange



DIMENSION SHAFT DIAMETER A 10mm*

*TOLERANCE H7 = 0... +0.018mm

60.0 ± 0.1 -

42.0 -

± 0.1

120° 3 PLCS

В

R WITH REPEATED BENDING ≥ 100mm R WITH SINGLE BEND ≥ 40mm

SHAFT DIAMETER	REQUIRED DIMENSION OF THE MOUNTING SHAFT (G8)
10mm	-0.00050.027mm
12mm	-0.0060.033mm

TOLERANCES EXCEPT WHERE NOTED (DIN 7168):

28mm

12mm

33mm

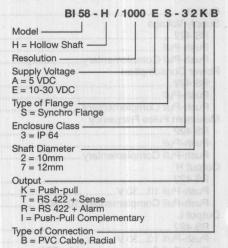
0-6mm	±0.1
6-30mm	±0.2
30-120mm	±0.3

CONNECTION DIAGRAM

Connec	ction Cable	Output	Circuit
Color	Wire Cross Section	RS 422 T and R	Push-Pull K and I
Red	0.5mm ²	5 VDC ±10%	1030 VDC
Red/Yellow	0.14mm ²	1030 VDC Sense Vcc ⁴	Sense Vcc
White	0.14mm ²	Channel A	Channel A
White/Brown	0.14mm ²	Channel A	Channel A ²
Green	0.14mm ²	Channel B	Channel B
Green/Brown	0.14mm ²	Channel B	Channel B2
Yellow	0.14mm ²	Channel N	Channel N
Yellow/Brown	0.14mm ²	Channel N	Channel N ²
Black	0.5mm ²	GND	GND
Black/Yellow	0.14mm ²	ERROR ³	ERROR

² Only push-pull, complementary(I)

HOW TO ORDER



STANDARD RESOLUTIONS AVAILABLE

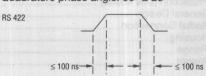
MAILAD			
5	160	500	1600
10	180	512	1800
20	200	600	1885
25	250	720	2000
30	256	900	2048
50	280	1000	2500
60	300	1024	3600
100	360	1250	3925
120	400	1270	4096
128	480	1500	5000

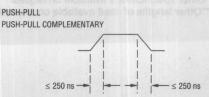
Consult factory for non-standard resolutions.

DELAY TIMES FOR 1.5M LEAD

Pulse shape: _ Pulse duty factor: 1:1

Quadrature phase angle: 90° ± 25°





Specifications are subject to change without notice.

³ Alternately sense GND

⁴ Only with 5 VDC supply voltage (do not connect with Red 0.5mm²)

ABSOLUTE SHAFT ENCODER, 10-24 BIT

a Short circuit proof

a Multitum

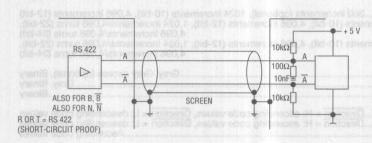
a Opto-A8IC

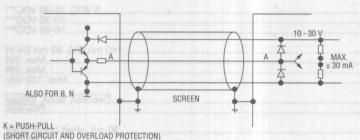
2.21 HEDETON ...

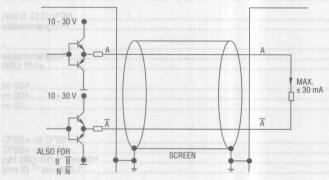
Model BI 58-H

Bourns® Encoders

OUTPUT CIRCUIT

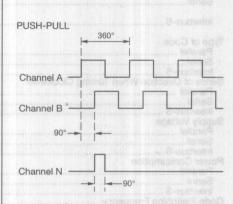




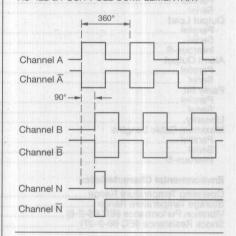


I = PUSH-PULL COMPLEMENTARY (SHORT CIRCUIT AND OVERLOAD PROTECTION)

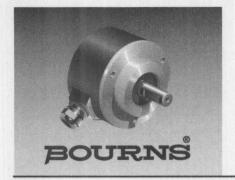
OUTPUT TABLE (Shaft turning clockwise as seen from front of encoder)



RS-422 & PUSH-PULL COMPLEMENTARY



For accessories, see pages 217-223.



ABSOLUTE SHAFT ENCODER, 10-24 BIT

- Single-turn
- Multiturn
- Opto-ASIC
- Parallel, tristate
- INTERBUS-S

Short circuit proof

■ SSI

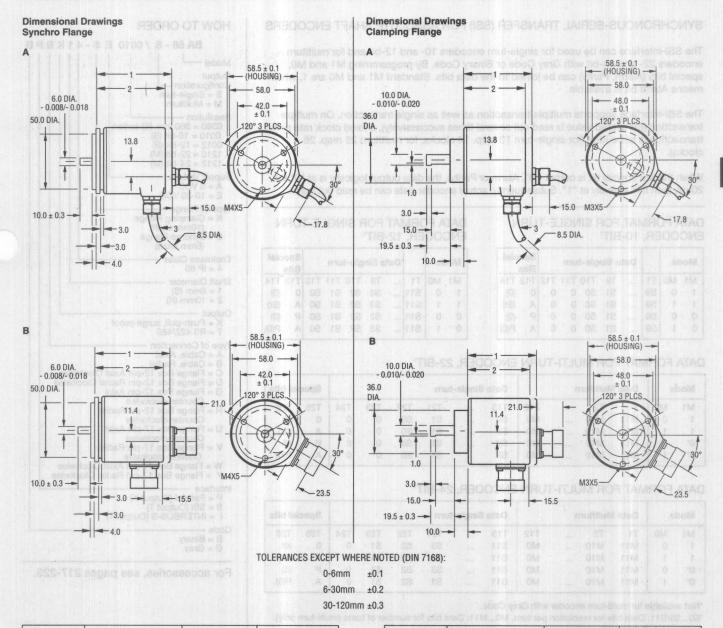
Model BA 58

	Parallel, serial (SSI), Interbus-S (ENCOM-profile K
Resolution	
Parallel Serial	
Interbus-S	4,096 increments/4,096 turns (24-b 1,024 increments (10-bit), 4,096 increments (12-bit), 1,024 increments/4,096 turns (22-bit), 4,096 increments/4,096 turns (24-b
ype of Code	
	Gray, Bina
	Bina
ense of Direction When Turning Clockwise	
Parallel	Direction = H: ascending code values, <u>Direction = L: descending code values.</u> Direction = H: ascending code values. <u>Direction = L: descending code values.</u>
Interhus-S	Ascending code values, birection = L. descending code values
unnly Voltage	
Parallel	5 VDC, 10-30 VDC
Serial	
Interbus-S	
	Max. 2
noute	
Parallel	
Serial	Direction
Output Load	
	RS 4
Narm Output	NPN O.C. 5 m
Sarial	
Parity Bit	Frogramma.
	±1/2 LS
Maximum Cable Lengths	
Interbus-S	50
Environmental Characteristics	-10°C to +60°
Storage Temperature Range	-10°C to +60°
/ibration Performance (IEC 68-2-6)	100 ms ⁻² (10-500 H
	1,000 ms ⁻² (3 m
Mechanical Characteristics	
haft Diameter	
Maximum Shaft Load	6mm: Axial 60 N (13 lbs.), radial 110 N (24 lbs.); 10mm: Axial 107 N (24 lbs.), radial 160 N (35 lb
laximum Speed	
forment of Inertia	
	As per DIN VDE 01
Connection, Axial or Radial	1.5-m cable** or flange b
lousing	Aluminu
lange	S = synchro flange, K = clamping flan
Veight	300g appro
Bearing Life	1 X 10 ^{to} revolutions (typ.) at 35% of full rated shaft loa 1 X 10 ^o revolutions (typ.) at 75% of full rated shaft loa 1 X 10 ^o revolutions (typ.) at 100% of full rated shaft loa 1 X 10 ^o revolutions (typ.) at 100% of full rated shaft loa
	1 X 10° revolutions (typ.) at 100% of full rated shaft lo. For example, 30,000 h at 6,000 RPM with a 13 lb. radial load (10mm or 9.52 mm sha

^{*}Other specifications available on request **Other lengths of cable available on request

Model BA 58

Bourns® Encoders



Drawing	Connection	Length ST	Length MT
Α	Cable Axial	1 = 62mm	1 = 80.5mm
Α	Cable Radial	2 = 56.5mm	2 = 75.5mm
В	Flange Box Axial	1 = 58mm	1 = 85.5mm
В	Flange Box Radial	2 = 56.5mm	2 = 80.5mm

Drawing	Connection	Length ST	Length MT		
Α	Cable Axial	1 = 57mm	1 = 75.5mm		
Α	Cable Radial	2 = 51.5mm	2 = 70.5mm		
В	Flange Box Axial	1 = 53mm	1 = 80.5mm		
В	Flange Box Radial	2 = 51.5mm	2 = 75.5mm		

Model BA 58

Model BA 58

Bourns® Encoders

SYNCHRONOUS-SERIAL TRANSFER (SSI) FOR ABSOLUTE SHAFT ENCODERS

The SSI-interface can be used for single-turn encoders 10- and 12-bit and for multiturn encoders 22- and 24-bit with Gray Code or Binary Code. By programming M1 and M0, special bits (Alarm, Parity) can be joined to the data bits. Standard M1 and M0 are 1, which means Alarm bit is available.

The SSI-interface supports multiple transaction as well as single transaction. On multiple transaction (the stored value is read out several times successively), a fixed clock rate per transaction is to be kept (for single-turn 13 resp. 14 clocks, for multiturn 25 resp. 26 clocks).

When the last special bit is output ("0", Alarm or Parity), the data output logically is at "0" for 20 μs, then it is logically at "1". Subsequently, actual encoder data can be read out again.

DATA FORMAT FOR SINGLE-TURN **ENCODER, 10-BIT**

Mod	de		Da	ta Sir	ngle-1	turn		Spe Bits	
M1	MO	T1		T9	T10	T11	T12	T13	T14
1	0	S9		S1	SO	0	0	0	(0)
1	1	S9		S1	SO	0	0	Α	(St)
0	0	S9		S1	SO	0	0	P	(0)
0	1	S9		S1	SO	0	0	Α	P(0)

DATA FORMAT FOR SINGLE-TURN ENCODER, 12-BIT1

Mode			Da	ta Sir	ngle-t	urn		Spe Bits	
M1	MO	T1		T9	T10	T11	T12	T13	T14
1	0	S11		S3	S2	S1	SO	0	(0)
1	1	S11		S3	S2	S1	SO	A	(St)
0	0	S11		S3	S2	S1	SO	P	(0)
0	1	S11		S3	S2	S1	SO	A	P(0)

DATA FORMAT FOR MULTI-TURN ENCODER, 22-BIT1

Mode Data Multiturn				Data	Data Single-turn					Spec	Special bits	
M1	МО	T1	T2	 T12	T13		T21	T22	T23	T24	T25	T26
1	0	M11	M10	 MO	S9		S1	SO	0	0	0	(0)
1	1	M11	M10	 MO	S9		S1	.SO	0	0	A	(St)
0*	0	M11	M10	 MO	S9		S1	SO	0	0	P	(0)
0*	1	M11	M10	 MO	S9		S1	SO	0	0	A	P(0)

DATA FORMAT FOR MULTI-TURN ENCODER, 24-BIT

Mode Data Multiturn				Data	Single-		Spec	Special bits				
M1	MO	T1	T2	 T12	T13		T21	T22	T23	T24	T25	T26
1	0	M11	M10	 MO	S11		S3	S2	S1	0	0	(0)
1	1	M11	M10	 MO	S11		S3	S2	S1	0	A	(St)
0*	0	M11	M1C	MO	S11		S3	S2	S1	0	P	(0)
0*	1	M11	M10	 MO	S11		S3	S2	S1	0	A	P(0)

*Not available for multi-turn encoder with Gray Code.

So...S9/S11: Data bits for resolution per turn. Mo...M11: Data bits for number of turns (multi-turn only). A: Alarm bit. P: Parity bit.

(St): Standard. (0): Option.

HOW TO ORDER

BA 58 - S / 0010 E S - 41 K B P B

lodel BA 58

Model — Output Configuration —
S = Single-turn
M = Multiturn Resolution -

0360 = 360 incr. (S) option 0010 = 10-bit (S) 0012 = 12-bit (S)

1210 = 22-bit (M) 1212 = 24-bit (M)

Supply Voltage — A = 5 VDC E = 10-30 VDC

Type of Flange K = Clamping Flange (10mm shaft) S = Synchro Flange (6mm shaft)

Enclosure Class 4 = IP 65

Shaft Diameter 1 = 6mm (S) 2 = 10mm (K)

Output -K = Push-pull, surge-proof T = RS 422/485

Type of Connection

ype of Connection
A = Cable, Axial
B = Cable, Radial
C = Flange Box 12-pin Axial Clockwise
D = Flange Box 12-pin Radial Clockwise
G = Flange Box 12-pin Axial
Counter-clockwise
A = Flange Box 12, pin Padial

H = Flange Box 12-pin Radial Counter-clockwise U = Flange Box 17-pin Axial

Counter-clockwise V = Flange Box 17-pin Radial

Counter-clockwise
W = Flange Box 17-pin Axial Clockwise
Y = Flange Box 17-pin Radial Clockwise

P = Parallel (Output K)

S = SSI (Output T) I = INTERBUS-S (Output T)

Code B = Binary G = Gray

For accessories, see pages 217-223.

Model BA 58

Bourns® Encoders

CONNECTION DIAGRAM Parallel Interface with Cable

Color	9-Bit/360 Incr.	10-Bit	12-Bit
Brown/Grey N.C.		N.C.	D0 (LSB)
Red/Blue	N.C.	N.C.	D1
Violet	N.C.	D0 (LSB)	D2
White/Brown	D0 (LSB)	D1	D3
White/Green	D1	D2	D4
White/Yellow	D2	D3	D5
White/Grey	D3	D4	D6
White/Pink D4		D5	D7
White/Blue	D5	D6	D8
White/Red	D6	D7	D9
White/Black	D7	D8	D10
Brown/Green	D8 (MSB)	D9 (MSB)	D11 (MSB)
Yellow	Tristate D0D8	Tristate D0D9	Tristate D0D11
Pink	Latch (binary only)	Latch (binary only)	Latch (binary only)
Green	Direction	Direction	Direction
Black	.0 V	0 V	0 V
Red	5 V/10,30 VDC	5 V/1030 VDC	5 V/1030 VDC
Brown	Alarm	Alarm	Alarm

CONNECTION DIAGRAM Interbus-S Interface

CABLE	FLANGE BOX	SIGNAL
Brown	1	D02
Red	2	D02
Pink	3	DI2
Yellow	4	DI2
Green	5	D01
Blue	6	D01
Violet	7	DI1
Grey	8	DI1 DI1
White	9	RBST
Brown (0.5mm²)	10	0 V
Black	11	Signal Ground
White (0.5mm²)	12	1030 VDC

CONNECTION DIAGRAM Parallel Interface with Flange Box, 17-pin (Conin)

Color	9-Bit/360 Incr.	12-Bit			
-1 XX 90	D0 (LSB)	D0 (LSB)	D0 (LSB)		
2	D1	D1	D1		
3	.D2	D2	D2		
4	D3	D3	D3		
5	D4	D4	D4		
6	D5	D5	D5		
7	D6	D6	D6		
8	D7	D7 D7			
9	D8 (MSB) D8		D8		
10	N.C.	N.C.	D9		
11	N.C.	N.C.	D10		
12	Tristate D0D8	Tristate D0D9	D11 (MSB)		
. 13	Latch (binary only)	Latch (binary only)	Latch (binary only)		
14	Direction	Direction	Direction		
15	0 0V	0 V	0 V		
16	5 V/1030 VDC	5 V/1030 VDC	5 V/1030 VDC		
17	Alarm	Alarm	Alarm		

CONNECTION DIAGRAM SSI-Interface

CABLE	FLANGE BOX	SIGNAL
Brown (0.5mm²)	1	0 V
Pink	2	Data
Yellow	3	Clock
	4	N.C.
Blue	5	Direction
Red	6	NC
Violet	7	NC
White (0.5mm²)	8	1030 VDC
	9	N.C.
Grey	10	Data
Green	. 11	Clock
Black	12	Signal Ground

Model BA 58

Bourns® Encoders

INTERBUS-S (2-wire remote bus)

Data Output	5 V differential signa ENCOM-profile K2,		ss data bina		djust, readable on	ly, without contro	ol/status bit
Data Transfer Format (According to F. Phoenix)	Sμpi-address 0	1	2	3	(83,000	N.C.	1 skolv
	Byte-No. 3	2	120	0			
ID-Code	236H		80		£6.	40	

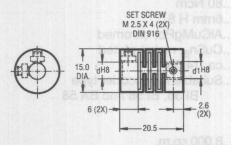
Encoder Data Format

TA L	10		Byte	3		O.M		01		00		Byte 2	10		201	Daily and I've
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	Bit-No.
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	. 0	10-Bit Encoder
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12-Bit Encoder
0	0	0	0	0	0	VO	0	0	0	M11	M10	M9	M8	M7	M6	22-Bit Encoder
0	0	0	0	0	0	0	0 0	M11	M10	M9	M8	M7	M6	M5	M4 .	24-Bit Encoder
	elou-		Byte	1		TOTAL A				time	A.	Byte 0	na)A.		malA	rimovi
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit-No.
0	0	0	0	0	0	S9	S8	S7	S6	S5	S4	S3	S2	S1	SO	10-Bit Encoder
0	0	0	0	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	SO	12-Bit Encoder
M5	M4	МЗ	M2	M1	MO	S9	S8	S7	S6	S5	S4	S3	S2	S1	SO	22-Bit Encoder
МЗ	M2	M1	MO	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	SO	24-Bit Encoder

OPTO-ASIC ENCODER ACCESSORIES Flexible Couplings

Shaft encoders must be protected against excessive mechanical stresses, which occur whenever there are angular, radial or axial misalignments between the machine and shaft encoder shafts. Our flexible couplings can compensate for this within limits.

Plastic coupling



Maximum speed	10,000 r.p.m.
Maximum torque	20 Ncm
Moment of inertia	1.1 gcm ²
Torsional spring constant	25 Ncm/degree
Max. angular misalignment	±2.5°
Max. shaft misalignment radial/a	

Max. tightening torque of set screws..30 Ncm

Material.....Polyamide 6.6 fiberglass reinforced

Weightca. 3.5g

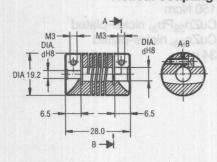
Hub diameter

5/5mm Ordering code 3 520 034....Suitable for encoder type

5/6mm Ordering code 3 520 033 6/6mm Ordering code 1 761 026

BI 39, BI 31

Helical coupling



Maximum speed.................6,000 r.p.m. Maximum torque80 Ncm

Moment of inertia......8.7 gcm² Torsional spring constant14 Ncm/degree

Max. angular misalignment.....±4°

Max. shaft misalignment radial/axial±0.25mm/±0.4mm

Max. tightening torque of set screws80 Ncm

Material.....AlCuMgPb, chromed

Weight16 g

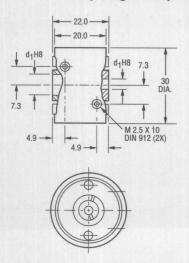
Hub diameter

5/5mm Ordering code 3 520 036......Suitable for encoder type 5/6mm Ordering code 3 520 035

6/6mm Ordering code 0 070 653

BI 30, BI 36, BI 39, BI 58

Diaphragm coupling



Electrically insulating coupling

Maximum speed.....12,000 r.p.m. Maximum torque40 Ncm Moment of inertia.....25 gcm² Torsional spring constant160 Ncm/degree Max. angular misalignment±2.5°

Max. shaft misalignment radial/axial±0.4mm/±0.4mm

Max. tightening torque of set screws80 Ncm

Material - flangezinc diecasting

Material - housing.....polyamide 6.6, fiberglass reinforced

Weight23g

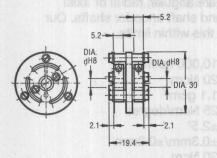
Hub diameter

6/6mm Ordering code 1 076 013......Suitable for encoder type 6/10mm Ordering code 1 076 015 BI 36, BI 58, BA 58

10/10mm Ordering code 1 076 014

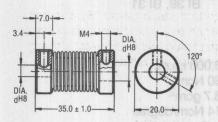
OPTO-ASIC ENCODER ACCESSORIES Flexible Couplings

Flange-face coupling



Maximum speed	12,000 r.p.m.
Maximum torque	80 Ncm
Moment of inertia	19 gcm ²
Torsional spring constant	230 Ncm/degree
Max. angular misalignment	±3.0°
Max. shaft misalignment radial/	axial±0.4mm/±0.4mm
Max. tightening torque of set so	
Hub diameters, d and d ₁	6mm H 8
Material - coupling body, flange	
Material - preloaded disc	CuSn ₆ , nickel-plated
Weight	ca. 14.5g
Ordering code 0 070 663	Suitable for encoder type
	BI 36, BI 58 and BA 58

Bellows coupling



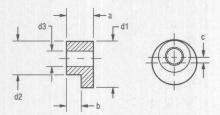
Maximum speed	8,000 r.p.m.
Maximum torque	80 Ncm
Moment of inertia	22 gcm ²
Torsional spring constant	230 Ncm/degree
Max. angular misalignment	±4.0°
Max. shaft misalignment radial/axial	±0.3mm/±0.5mm
Max. tightening torque of set screws.	150 Ncm
Material - flange	CuZn ₃₉ Pb ₃ , nickel-plated
Material - bellows	CuZn ₂₀ , nickel-plated
Weight	34 g
Hub diameter	
12/12mm Ordering code 0 070 666	

10/10mm Ordering code 3 520 037 3/8"/3/8" Ordering code 3 520 038



OPTO-ASIC ENCODER ACCESSORIES Mounting Accessories, Plug Connectors and Cable Sets

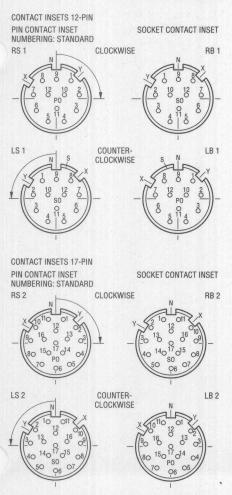
Clamping eccentric



Material	CuZn ₃₉ Pb ₃
Surface	Nickel-plated
Set of three	shaft andoders (continued)
Suitable for type BI 58/BA 58	shaft encoders

	Dia.	Dia.	Dia.			
	d ₁	d ₂	d ₃	a	b .	С
Ordering code 0 070 655	8.9	6.5	3.2	4.9 - 0.1	2.9 - 0.1	1.2
Ordering code 3 520 042	6.8	5.0	2.8	4.4 - 0.1	2.4 - 0.1	0.9

Cable plug connectors for incremental and absolute shaft encoders



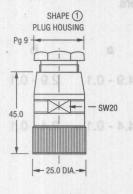
The RK series can be fitted out with standard strain reliefs. By compact dimensions the connector series stands the test wherever parts must have small measures, a stable design, high durability and EMC-density and where they must be dust- and waterproof as well as resistable against corrosion.

Ordering Code	Shape	Polarity	Design	Remarks
3 539 198	2	RS1	Flange box	Identical with encoder flange box 12-pin clockwise
3 539 230	2	LS1	Flange	Identical with encoder flange box 12-pin anti-clockwise
3 539 202	1	RB1	Connector	Matching with encoder flange box 12-pin clockwise
3 539 229	1	LB1	Connector	Matching with encoder flange box 12-pin anti-clockwise
3 539 301	7	RS1	Coupling	Matching with connector 3 539 202
3 539 273	7	LS1	Coupling	Matching with connector 3 539 229
3 539 253	2	RS2	Flange box	Identical with encoder flange box 17-pin clockwise
3 539 255	2	LS2	Flange box	Identical with encoder flange box 17-pin anti-clockwise
3 539 254	no (text)	RB2	Connector	Matching with encoder flange box 17-pin clockwise
3 539 256	1	LB2	Connector	Matching with encoder flange box 17-pin anti-clockwise
3 539 302	7	RS2	Coupling	Matching with connector 3 539 254
3 539 303	7	LS2	Coupling	Matching with connector 3 539 256
3 539 186	1	RS1	Connector	Matching with coupling 3 539 187
3 539 187	1	RB1	Coupling	Matching with connector 3 539 186

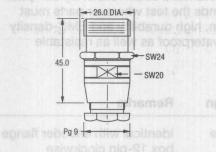


OPTO-ASIC ENCODER ACCESSORIES PERIODICE DISA-0190 Mounting Accessories, Plug Connectors and Cable Sets

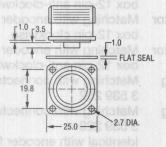
Cable plug connectors for incremental and absolute shaft encoders (continued)



SHAPE (7) CONNECTOR HOUSING

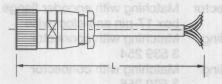


SHAPE (2) FLANGE BOX FOR FRONT MOUNTING

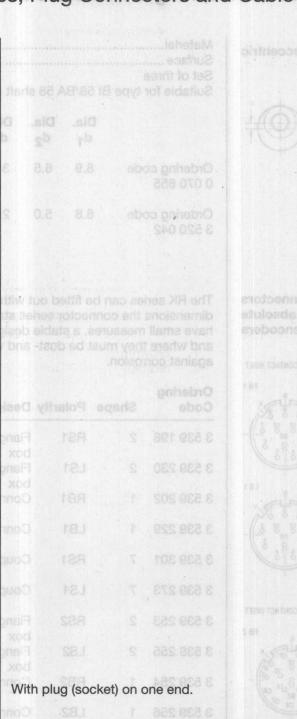


TPE-Extension leads

Concector



With plug (socket) on one end.















OPTO-ASIC ENCODER ACCESSORIES Mounting Accessories, Plug Connectors and Cable Sets

(Co	nin	12-	pin
for	BI	58,	BA	58

Pin	Color	Length (L)	Clockwise ¹⁾ Ordering Code	Counterclockwise ²⁾ Ordering Code
1	pink	L = 3m	1 522 348	1 522 394
2	blue	L = 5m	1 522 349	1 522 395
3	red	L = 10m	1 522 350	1 522 396
4	black			
5	brown			
6	green			
7	violet			
8	gray			
9	screen			
10	white/green			
11	white			
12	brown/green			

¹⁾ matching with encoder flange box 12-pin, clockwise

Conin 17-pin for BA 58

Pin	Color	Length (L)	Clockwise ¹⁾ Ordering Code	Counterclockwise ²⁾ Ordering Code
1	brown/gray	L = 3m	1 540 100	1 540 097
2	red/blue	L = 5m	1 540 101	1 540 098
3	violet	L = 10m	1 540 102	1 540 099
4	white/brown			
5	white/green			
6	white/yellow			
7	white/gray			
8	white/pink			
9	white/blue			
10	white/red			
11	white/black			
12	brown/green			
13	pink			
14	green			
15	black 0.5			
16	red 0.5			
17	brown			

¹⁾ matching with encoder flange box 17-pin, clockwise

Binder 6-pin for BI 36

Pin	Color	Length (L)	Ordering Code
1 = A(G, 20, 1)	red	L = 10m	1 522 340
2	white		
3	yellow		
4	green		
5	yellow/black		
6	black		
Housing	screen		

Cable onnectors

not made up with connectors

Specifications are subject to change without notice.

TPE-cable (12 conductors)

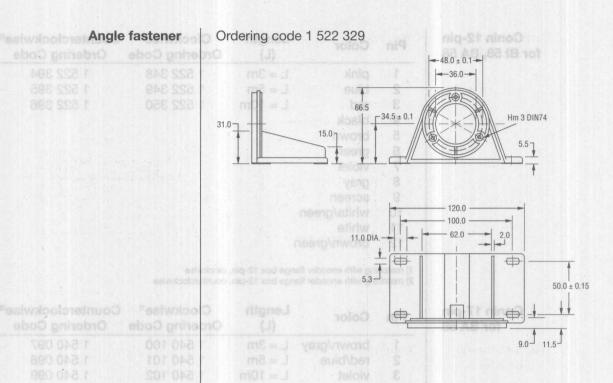
Ordering Code
3 280 112 + length

²⁾ matching with encoder flange box 12-pin, counterclockwise

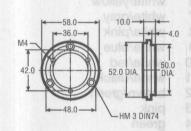
²⁾ matching with encoder flange box 17-pin, counterclockwise



OPTO-ASIC ENCODER ACCESSORIES Mounting Accessories



Synchro flange adapter

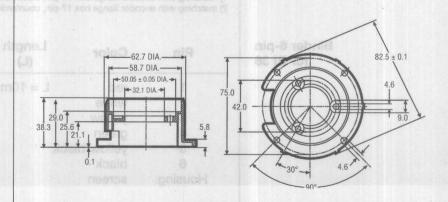


Ordering code 1 522 328

Mounting bell

Ordering Code 3 280 112 + length

Ordering code 1 522 330





OPTO-ASIC ENCODER ACCESSORIES Mounting Accessories

VDE 0160 stigulates that the operator must ensure that the case

copy of the delivery slip and a note describing the problem

Please rater to the warranty and tents and conditions for further details

Modification of the encoder lise! Is not necessary. Unauthorized tampering with the encoder results in the loss of functional reliability.

The ASIC rotary encoders are precision mechanical and opto-

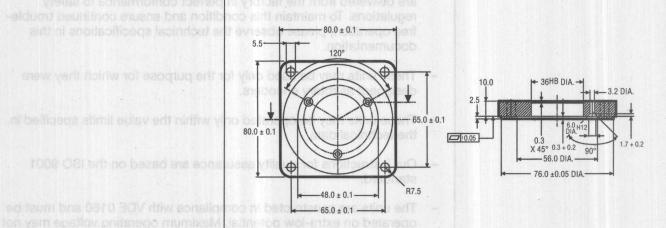
Avoid shocks to the case and especially to the encoder shall

Avoid excess exial loads to the encoder shaft.

To ensure proper operation, install the encoders only as described in these instructions. The accuracy of shaft encoders, in particular, is only guaranteed if the recommended couplings are used frefer to

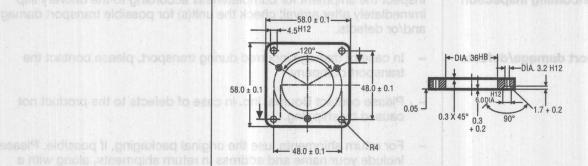
electronic devices. Due care must, therefore, be taken when handling

Square flange 80 x 80mm Ordering code 1 522 327



Square flange 58 x 58mm

Ordering code 1 522 326





OPTO-ASIC ENCODER SAFETY AND INSTALLATION INSTRUCTIONS

Safety Instructions

- The ASIC rotary encoders are quality products manufactured in accordance with established electrical engineering norms. The units are delivered from the factory in perfect conformance to safety regulations. To maintain this condition and ensure continued troublefree operation, please observe the technical specifications in this documentation.
- These units may be used only for the purpose for which they were designed: as rotary encoders.
- These units may be operated only within the value limits specified in the technical data.
- Our instructions for quality assurance are based on the ISO 9001 standard.
- The units are constructed in compliance with VDE 0160 and must be operated on extra-low potential. Maximum operating voltage may not be exceeded.
- VDE 0160 stipulates that the operator must ensure that the case temperature of units installed within arms reach does not exceed 65°C.

Incoming inspection

Inspect the shipment for completeness according to the delivery slip immediately after arrival; check the unit(s) for possible transport damage and/or defects.

Transport damage/defects

- In case of damage incurred during transport, please contact the transport company.
- Please contact Bourns, Inc. in case of defects to the product not caused by shipping.
- For return shipments, use the original packaging, if possible. Please include your name and address in return shipments, along with a copy of the delivery slip and a note describing the problem discovered. Call for authorization.

Liability for defects

Additional important information

Please refer to the warranty and terms and conditions for further details.

- Modification of the encoder itself is not necessary. Unauthorized tampering with the encoder results in the loss of functional reliability and voids the warranty.
- To ensure proper operation, install the encoders only as described in these instructions. The accuracy of shaft encoders, in particular, is only guaranteed if the recommended couplings are used (refer to Accessories).
- The ASIC rotary encoders are precision mechanical and optoelectronic devices. Due care must, therefore, be taken when handling these units.
- Avoid shocks to the case and especially to the encoder shaft.
- Avoid excess axial loads to the encoder shaft.



OPTO-ASIC ENCODER SAFETY AND INSTALLATION INSTRUCTIONS

Installation Instructions

es as stipulated in IEC 801, and only by

- All installation work must be carried out in accordance with the relevant safety regulations.
- All equipment involved must be electrically disconnected during installation. Ensure that current cannot be applied to this equipment unintentionally during installation.
 - Self-tapping screws:
 - are not to be used for mounting the couplings on hardened encoder shafts; use clamp types instead.
 - may be used for unhardened encoder shafts.
 - Turn the self-tapping screws until the shaft surface is reached, so that the displaced material does not impede later removal of the shaft.

Preparations for mechanical installation

duct a trial run.

Before starting the installation, the device turning the encoder shaft ("drive") must be prepared to receive the rotary encoder.

Due to the wide range of drive construction and installation requirements, only general instructions can be provided; please refer to the dimensioned drawings of the different rotary encoder versions. If adapters between the drive and rotary encoder are used, the adapters must be designed so that:

- the rotary encoder can be mounted securely and is not subject to vibration;
- the rotary encoder can be mounted to the drive first, then the drive's shaft end coupled with the rotary encoder shaft; and
- the radial and axial offset and angle errors remain within the specified tolerances.

Note: The service life of the coupling is largely dependent on proper mounting. The coupling must be attached in its neutral position. Forced compression or extension and/or compensation of an angle which is too wide, or excessive shaft offset shortens service life.

Mechanical installation instructions

At this point, the preparations required for the drive and adapter, or for the mounting bell, must be completed.

- Mount the adapter or the mounting bell on the drive housing;
- Slide the coupling over the shaft end of the drive;
- Mount the rotary encoder to the adapter or the mounting bell and secure;
- Tighten the coupling screws.

Preparations for electrical installation

The preparations for electrical installation vary depending on whether the rotary encoder is equipped with a cable or flange-type socket connection.



OPTO-ASIC ENCODER SAFETY AND INSTALLATION INSTRUCTIONS

sioned drawings of the different rotary encoder versions. If adapters between the drive and rotary encoder are used, the adapters must be

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At this point, the preparations raquited for the drive and adapter, or for

Mount the adapter or the mounting bell on the drive housing:

Mount the rotary encoder to the adapter or the mounting ball and

The preparations for electrical installation vary depending on whether the

rotary encoder is equipped with a cible or flange-type sucket

shaft end coupled with the rotary encoder shaft; and

wide, or excessive shaft offset shortens service life.

Slide the coupling over the shall end of the drive;

the mounting bell, must be completed.

Cable connection

annot be applied to this

The ends of the cable have been prepared for a connector which corresponds to your requirements. Please note the output circuit integrated in the rotary encoder and the corresponding assignment of the wires.

Soldering the cable to the mating connector

electrically disconnected during

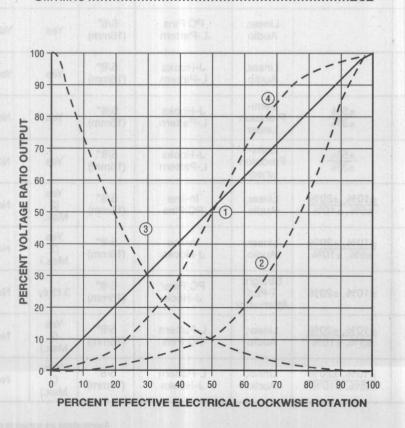
The procedures for wiring the mating connector are to be carried out according to the EMC guidelines as stipulated in IEC 801, and only by individuals familiar with appropriate connection techniques.

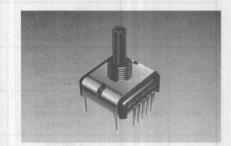
Electrical installation instructions

ve construction and installation requirements

- Position the cable so that it does not obstruct or limit the required free movement of the unit and, at the same time, is not stretched tight or pinched. Avoid tight bending of the cable near moving joints (e.g., is upil the shaft surface is reached, so that robot arms). Please refer to the bend radii given in the dimensioned hada edi to isvoma netal epagni ton a drawings. I hoosicalb edi
 - In compliance with the above requirements, position the cable along scelve the rotary encoder. the shortest possible path to the control system and connect the cable to the control system.
 - metalls will be taken seemed a basis of the Switch on the system and conduct a trial run.

Panel Controls I. Product Selection Guide228 II. Taper Descriptions......230 III. Mounting Hardware......230 IV. Panel Controls 6mm Square231 6mm Square with Switch231 9mm Square233 9mm Square with Switch233 13mm Diameter Pot/Switch237 1/2" (12.5mm) Square239 5/8" (16mm) Square242, 243, 246, 250 5/8" (16mm) Square with Switch......245, 251 3/4" (19mm) Diameter255 1/2" (12.7mm) Diameter257 V. Attenuators Variable......254 VI. Potentiometers Open Frame Slide.....259







PRODUCT SELECTION GUIDE Panel Controls

Model No.	Turns	Element Type	Tolerance	Tapers	Terminal Style	Package Dim.	Multi. Sec. Avail.	Switch Avail.	Page No.
39	Single	Conductive Plastic	±20%	Linear, Audio			No	Yes	237
51	Single	Cermet Conductive Plastic	±5%, ±10% ±10%, ±20%	Linear, Audio	In-line PC Pins 2.54mm Centers	1/2" (12.5mm)	Yes	No	239
52	Single	Cermet Conductive Plastic	±5%, ±10% ±10%, ±20%	Linear, Audio	In-line PC Pin 5.08mm Centers	1/2" (12.5mm)	Yes	No	239
53	Single	Cermet Conductive Plastic	±5%, ±10% ±10%, ±20%	Linear, Audio	Solder Lugs	1/2" (12.5mm)	Yes	No	239
81	Single	Cermet Conductive Plastic	±5%, ±10% ±10%, ±20%	Linear, Audio	PC Pins L-Pattern	5/8" (16mm)	Yes	No	242
82	Single	Cermet Conductive Plastic	±5%, ±10% ±10%, ±20%	Linear, Audio	J-Hooks L-Pattern	5/8" (16mm)	Yes	No	242
81/82	Single	Cermet	±10%, ±20%	Straight T-Pad Attenuator	PC Pins/ J-Hooks L-Pattern	5/8" (16mm)	3 Only	No	254
83	10	Wirewound Hybritron®	±5% ±10%	Linear	PC Pins	5/8" (16mm)	Yes	No	243
84	10	Wirewound Hybritron®	±5% 10%	Linear	Solder Lugs	5/8" (16mm)	Yes	No	243
85	Single	Conductive Plastic Cermet		Linear, Audio	PC Pins L-Pattern	5/8" (16mm)	Yes	Yes	245
86	Single	Conductive Plastic Cermet		Linear, Audio	J-Hooks L-Pattern	5/8" (16mm)	Yes	Yes	245
87	Single	Conductive Plastic Cermet	±5% ±3%	Semi- Precision Linear	J-Hooks L-Pattern	5/8" (16mm)	Yes	No	246
88	Single	Conductive Plastic Cermet	±5% ±3%	Semi- Precision Linear	J-Hooks L-Pattern	5/8" (16mm)	Yes	No	246
91	Single	Conductive Plastic Cermet	±10%, ±20% ±5%, ±10%	Linear, Audio	In-line PC Pins	5/8" (16mm)	Yes (2 Max.)	No	250
92	Single	Conductive Plastic Cermet	±10%, ±20% ±5%, ±10%	Linear, Audio	In-line J-Hooks	5/8" (16mm)	Yes (2 Max.)	No	250
91/92	Single	Cermet	±10%, ±20%	Straight T-Pad Attenuator	PC Pins/ J-Hook	5/8" (16mm)	3 Only	No	254
93	Single	Conductive Plastic Cermet	±10%, ±20% ±5%, ±10%	Linear, Audio	L-Pattern PC Pins	5/8" (16mm)	Yes (2 Max.)	No	250
94	Single	Conductive Plastic Cermet	±10%, ±20% ±5%, ±10%	Linear, Audio	L-Pattern J-Hooks	5/8" (16mm)	Yes (2 Max.)	No	250



PRODUCT SELECTION GUIDE Panel Controls

Model No.	Turns	Element Type	Tolerance	Tapers	Terminal Style	Package Dim.	Multi. Sec. Avail.	Switch Avail.	Page No.
95	Single (Sealed)	Conductive Plastic Cermet	±10%, ±20% ±5%, ±10%	Linear, Audio	Triangle Pattern Solder Lugs	5/8" (16mm)	Yes (2 Max.)	No	250
96	Single	Conductive Plastic Cermet	±10%, ±20% ±5%, ±10%	Linear, Audio	In-line PC Pins (Sealed)	5/8" (16mm)	Yes (2 Max.)	No	250
97	Single	Conductive Plastic Cermet		Linear, Audio	L-Pattern PC Pins	5/8" (16mm)	Yes (2 Max.)	Yes	251
98	Single	Conductive Plastic Cermet		Linear, Audio	L-Pattern J-Hooks	5/8" (16mm)	Yes (2 Max.)	Yes	251
99	Single	Conductive Plastic Cermet		Linear, Audio	Triangle Pattern Solder Lugs	5/8" (16mm)	Yes (2 Max.)	Yes	251
3310	Single	Conductive Plastic	±20%	Linear	PC Board Bushing Mount	9mm	2 Max.	Yes	233
3370	Single	Conductive Plastic	±20%	Linear	PC Board Bushing Mount	6mm	2 Max.	Yes	231
3851	Single	Conductive Plastic	±10%, ±20%	Linear, Audio	PC Pins, Solder Lugs	3/4" (19mm)	No	No	255
3852	Single	Cermet	±5%, ±10%	Linear, Audio	PC Pins, Solder Lugs	3/4" (19mm)	No	No	255
3856	3-3/4	Cermet	±5%, ±10%	Linear, Audio	PC Pins, Solder Lugs	3/4" (19mm)	No	No	255
3862	Single	Cermet	±5%, ±10%	Linear, Audio	PC Pins, J-Hooks	1/2" (12.7mm)	No	No	257

Open Frame Slide Potentiometers

Model Series	Sections	Stroke Length	Terminal Styles	Element Types/Tapers	Page No.
SS	Single	10mm 15mm	PC Pins	Linear, LH Audio,	050
SD	Dual	20mm 30mm	Horizontal and Vertical	RH Audio, "S" Curve	259

Slimline Potentiometers

Model Series	Tapers	Tolerance	Standard Resistance Range	Terminal Styles	Sections	Page No.
PC	Linear CP CW Audio CP CCW Audio CP	±20%	500 Ω to 2.5 MΩ	PC Pin, Solder Lug	Single	262



MOUNTING HARDWARE

Panel control mounting hardware is determined by bushing style. The "X" in the bushing style column indicates what hardware is used with that bushing. Hardware indicated by shaded area is normally supplied with unit. Other hardware may be ordered separately. Hardware is bulk packaged with units.

					Bus	shing S	tyle						
Part Number and Description	A/S ENS	В	С	E	J	N	R	Т	U	L	w	3310/ 3370	S Mod. 50
H-36-1 Flat Washer	PRUE		X	X	more	X	409+ A9	X	ewi	Dubnod		Lucia D	
H-36-2 Flat Washer	X	X	TATAL SERVICE		X		Rots a	94,		13889		teline3)	28 m
H-37-1 Lockwasher			X	Χ		Χ		X					X
H-37-2 Lockwasher	X	X	109.0	ni-mi	X		95, ±20	Of a li		X	X	Annual S	20
H-38-1 Mounting Nut	(mme)		X	Χ	0/10/25	X		X		Cenno		X	
H-38-2 Mounting Nut	X	X			Х				evi	Hatino O		a sant	
H-38-3 Lock Nut	Toron 8.19		-24C 31	Χ	CANADARA CANADARA			X		teiri		would,	100
H-38-4 Lock Nut		Χ									6		- Mass
H-37-3 Lockwasher	Trana-		Patient	1	xparil				X	Sonduc			
H-37-4 Lockwasher	(mm8t)	145	expodia-		OlbuA		X			orug D		X	13 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
H-37-5 Lockwasher							Х		-			X	
H-38-8 M-7 Mounting Nut	1818	1	n athes		neeni.				X	me 191-1		Nonie	68
H-38-9 M-10 Mounting Nut	Value of the	8	AJ Táb	62	9.05.07		X			Cenne			
H-38-11 M-9 Mounting Nut										X	X		
H-38-14 M6 Mounting Nut	meric		rit i anno	ing !	usonic		28004			Mary 4		a goal	X

PANEL CONTROL OPTIONS MATRIX

	3851	3852	3856	3862	81/82	83/84	85/86	87/88	91-95	97-99	96	PC	50	EC	EN	3310/ 3370
Single Section	X	X	X	X	X	X	*	X	X	*	X	X	X	X	X	X
Dual Section	, old				X	X	X*	X	X	X*	Δ	VIDEOUS I	X	Siziéla	181	X
Triple Section		N. W.			X	Δ	Δ	X	Δ	Δ		- 100	X			
Quad Section					X	Δ	Δ	X	Δ	Δ		11000	X	DITAL		
.125" Shafts	X	X	X	X	X	X	X	X	X	X	X	. According	X	BILL AND	X	X
.185" Shafts		L. Un	men. I	- PD-	1 Spiller		GIDNA			Harris I had		X		X	Territa.	1100
.250" Shafts	X	X	X	21.66	- X	X	X	X	X	X	X	X	X	X	X	
3mm Shaft			Se III	17	19.09		anned I				1		X			
4mm Shaft	1990	a (m)	me to	gr.	X	X	X	X	X	X	X	MULTINO	X		The state	GOL
6mm Shaft					X	X	X	X	X	X	X	X	X	. X		
Dual Concentric Shafts					X	X	Δ	X				TANK T	Δ			
Switches	- on	Jeografia	S SHI		and the		X*	100	Ota ,	X*		3emher	2	all sig	MB L	X
Locking Bushing	X	X		X	X	X		X					Δ			

ΔConsult factory.

TAPER DESCRIPTIONS

Graph	Models	Taper Code	Description	Linearity	T.R. Tol.
1	1 81,82,85,86,91-99,3852,3856,3862,50		Linear — Cermet	±5% Ind.	±10%
1	81,82,85,86,91-99,3851,50	В	Linear — C.P.	±5% Ind.	±20%
2	81,82,85,86,91-99,3852,3856,50	С	CW Audio — Cermet	N/A	±10%
2	81,82,85,86,91-99,3851,50	D	CW Audio — C.P.	N/A	±20%
001	81,82,85,86,91-99,3851,50	E E	Linear — C.P.	±5% Ind.	±10%
3	81,82,85,86,91-99,3852,3856,50	V bos F	CCW Audio — Cermet	N/A	±10%
3	81,82,85,86,91-99,3851,50	G	CCW Audio — C.P.	N/A	±20%
1	81,82,85,86,91-99,3852,3856,3862	Н	Linear — Cermet	±5% Ind.	±5%
1	83,84	J	Linear — Wirewound	±.25% Ind.	±10%
1	83,84	K	Linear — Hybritron® Element	±.25% Ind.	±10%
1	87,88	L	Linear — C.P.	±2% Z.B.	±5%
1	87,88	M	Linear — Cermet	±2.5% Z.B.	±3%
1	87,88	N	Linear — C.P.	±1% Z.B.	±5%
1	87,88	Р	Linear — Cermet	±1.5% Z.B.	±3%
2	81,82,85,86,91-99,50	S	CW Audio — C.P.	N/A	±10%
3	81,82,85,86,91-99,50	T,	CCW Audio — C.P.	N/A	±10%
4	50	Υ	Dual Audio — C.P.	N/A	±20%
1	3310,3370	N/A	Linear — C.P.	±5% Ind.	±20%

^{*}Standard Construction - 1 pot section and 1 switch module.



6MM SQUARE PANEL CONTROL CONDUCTIVE PLASTIC, SEALED

■ Conductive plastic

- Linear
- PC board and bushing mount
- Plastic bushing and plastic shaft
- Withstands typical industrial washing processes
- Compact package saves board and panel space

Model 3370

▶® Panel Controls

Electrical Characteristics	
Standard Resistance Range	
Linear	1K ohms to 1 megohm
Total Resistance Tolerance	
Linear Tapers	±20%
	±5%
Effective Electrical Angle	280° nominal
Dielectric Withstanding Voltage	900 VAC minimum
Sea Level	900 VAC minimum
	issipation of 200 VAC, whichever is Lessy
Environmental Characteristics	
Storage Temperature	55°C to +125°C
	±1,000ppm/°C
	30G
	±1% maximum
	±1% maximum
	100G
	±1% maximum
Voltage Ratio Shift	±1% maximum
Load Life (1,000 Hours)	±10% TRS maximum
Rotational Life-No Load (10,000 Cycles)	±5% TRS maximum
CRV @ 5,000 Cycles	±2%
	±5% TRS
Seal lest	
Mechanical Characteristics	
Stop Strength	5.65 Ncm
Mechanical Angle	310° nominal
Torque	
Running	
Starting	
	Solderable pins
MarkingManufacturer's symbol ar	

STANDARD RESISTANCE TABLE

Resistance	Resistance
(Ohms)	Code
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105

Popular values listed in boldface. Consult factory for special resistances.

PART NUMBERING SYSTEM	3370 Y - 0 0 1 - 103
Model Number Designator — 3370 = 6mm Panel Control	3370 7 - 0 0 1 - 103
Terminal Style Designator Single Cup: C = In-line Straight Terminals Side Exit P = 5.08mm x 2.54mm Triangular Pattern Rear Exit Y = 5.08mm x 5.08mmTriangular Pattern Rear Exit	
Dual Cup: H = Dual In-line Straight Terminals Rear Exit	
Shaft End Designator 0 = Shaft End Slotted	
Shaft Length Designator — 0 = 12.7mm FMS Long Plastic Shaft	
Bushing Designator Pot (or Pot/Pot): 1 = 6.35mm x 6.35mm Plastic	
Pot/Switch Bushing Designator (use with "H" terminal style) 3 = 6.35mm x 6.35mm Plastic	
Resistance Code (1st 2 digits are significant, 3rd digit is number of 0s to follow)	

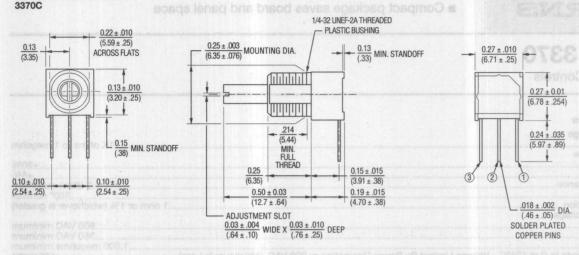
Specifications are subject to change without notice. *"Fluorinert" is a registered trademark of 3M Co.



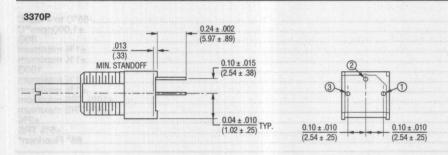
DIMENSIONAL DRAWINGS AND TOLERANCES Model 3370

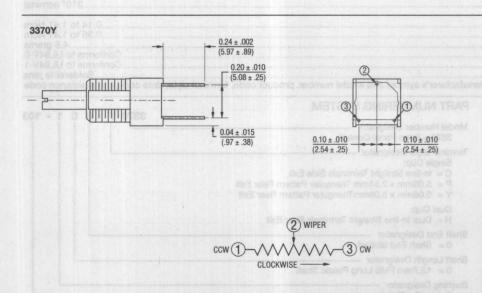
a Plastic bushing and plastic shaft

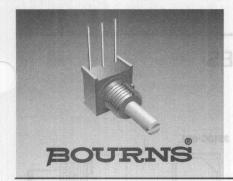
COMMON DIMENSIONS



Withstands fygical industrial washing processes







9MM SQUARE PANEL CONTROL CONDUCTIVE PLASTIC, SEALED

■ Conductive plastic

- Linear
- PC board and bushing mount
- Plastic bushing and plastic shaft
- Withstands typical industrial washing processes
- Compact package saves board and panel space

Model 3310

B® Panel Controls

Electrical Characteristics	
Standard Resistance Range - Linear	1K ohms to 1 megohm
Total Resistance Tolerance - Linear Tapers	±20%
Independent Linearity	
	2 ohms maximum
Dielectric Withstanding Voltage	
	350 VAC minimum
Power Rating @ 70°C (Derate to 0 at 125°C	Voltage Limited By Power Dissipation or 200 VAC, Whichever is Less)
See chart on page 14 for non-linear tapers	Vollage Elithod by Fower Dissipation of 200 Vito, Whichever is 2000,
Environmental Characteristics	(0.1 (0.1 (0.1 (0.1 (0.1 (0.1 (0.1 (0.1
Storage Temperature	55°C to +125°C
TCR (Over Storage Temperature Range)	±1,000ppm/°C
	30G
	±1% maximum
	±1% maximum
	100G
	±1% maximum
	±1% maximum
Potetional Life No. Load (FO.000 Cycles)	±10% TRS maximum
CDV	±5% TRS maximum ±1% or 1 ohm (whichever is greater)
	±10% TRS
	85° Fluorinert
	and the second s
Mechanical Characteristics	
Stop Strength	
	300° nominal
	4.5 grams
	Conforms to UL94V-0
	Conforms to UL94V-1
iviarking	Manufacturer's symbol and model number, product code, terminal style, date code and resistance code

STANDARD RESISTANCE TABLE

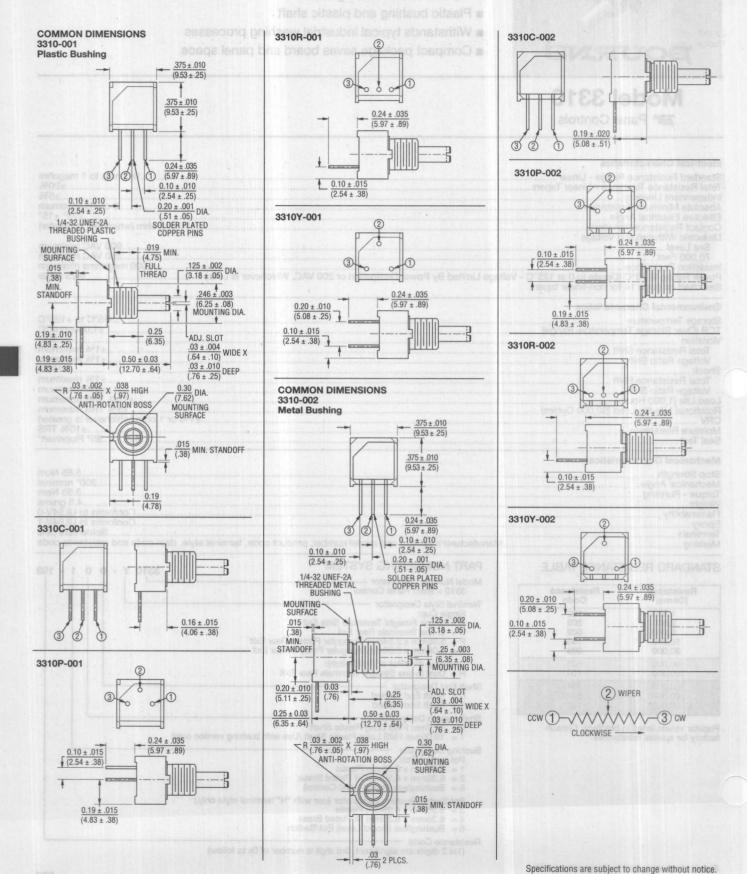
Resistance	Resistance
(Ohms)	Code
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105

Popular values listed in boldface. Consult factory for special resistances.

PART NUMBERING SYSTEM 3310 Y 0 Model Number Designator — 3310 = 9mm Panel Control Terminal Style Designator Single Cup: | C = In-line Straight Terminals Side Exit | | R = In-line Terminals Rear Exit | | P = 5.08mm x 2.54mm Triangular Pattern Rear Exit | Y = 5.08mm x 5.08mmTriangular Pattern Rear Exit Dual Cup (Pot/Pot or Pot/Switch): H = Dual In-line Straight Terminals Rear Exit Shaft End Designator — 0 = Shaft End Slotted 1 = Shaft End Flatted Shaft Length Designator 0 = 12.7mm FMS Long Plastic Shaft 1 = 19.05mm FMS Long Plastic Shaft (Use with bushing version only) **Bushing Designator** Pot (or Pot/Pot): 1 = 6.35mm x 6.35mm Plastic 2 = 6.35mm x 6.35mm Ni Plated Brass 5 = Bushingless (Board Level Control) Pot/Switch Bushing Designator (use with "H" terminal style only.) 3 = 6.35mm x 6.35mm Plastic 4 = 6.35mm x 6.35mm Ni Plated Brass 6 = Bushingless (Board Level) Pot/Switch Resistance Code (1st 2 digits are significant, 3rd digit is number of 0s to follow)

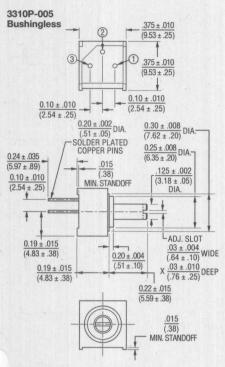


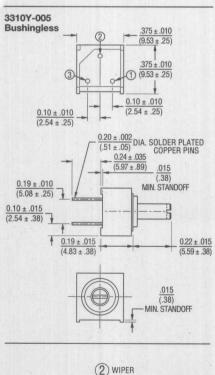
DIMENSIONAL DRAWINGS AND TOLERANCES Model 3310

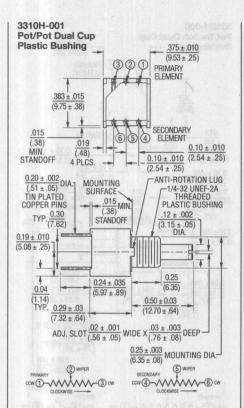


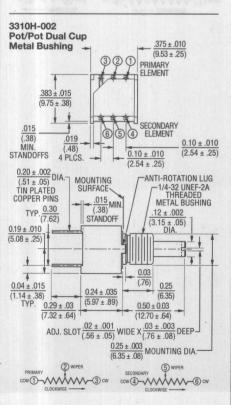


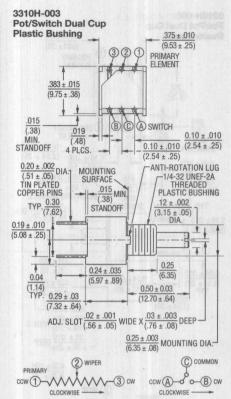
DIMENSIONAL DRAWINGS AND TOLERANCES Model 3310

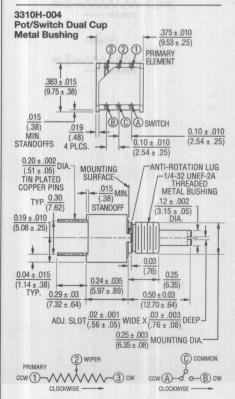












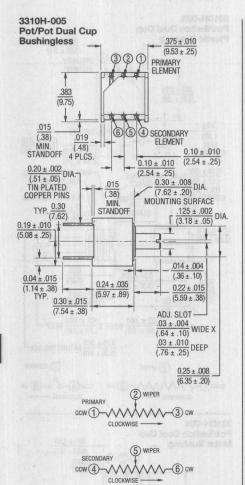
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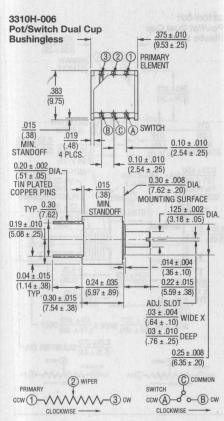
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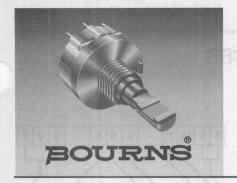
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DIMENSIONAL DRAWINGS AND TOLERANCES Model 3310







SEALED 13MM POT / SWITCH

- Low cost
- 50,000 cycle rotational life
- Linearity ± 5%
- Snap action rotary switch and push button switch available
- Six sigma design
- Wide range of standard resistance values and tapers

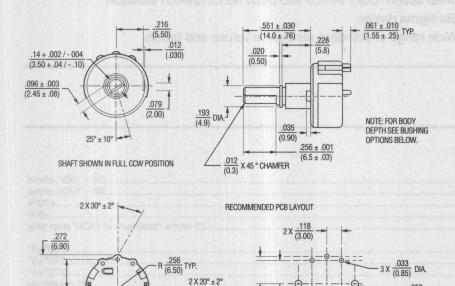
Model 39

Bourns® Pot/Switch

Electrical Characteristics		
Standard Resistance Range		
Linear	5K - 100K ohms	
Audio		
Total Resistance Tolerance.		
Independent Linearity		
Absolute Minimum Resistance		
Effective Electrical Angle	The state of the s	
Pot - No Switch	250°+5°	
Push/Momentary Switch		
Rotary Switch		
Contact Resistance Voltage	270 Maximum	
Dielectric Withstanding Voltage Sea Level	500 V/A O	
Insulation Resistance	100 megonms minimum	
Power Rating at 70°C (Derate to 0 at 125°C)		
(Voltage Limited by Power Dissipation or 350 VAC, Whichever is Less)	[[[조도]]] [[[[[[[]]]]]] [[[[]]] [[[]] [[]]	
Linear Taper	0.25 watt	
Audio Taper	0.125 watt	
Contact Rotary		
SPST	N.O.	
Power Rating (Resistive Load)		
Contact Resistance	100 milliohms maximum	
Contact Bounce		
Contact Push Momentary		
SPST	NO.	
Power Rating (Resistive Load)	10 milliamps @ 12 volts DC	
Contact Resistance		
Contact Bounce		
Environmental Characteristics Storage Temperature TCR (Over Storage Temperature Range)		
Vibration	15C	
Total Resistance Shift	10G movimum	
Voltage Ratio Shift		
Shock		
Total Resistance Shift		
Voltage Ratio Shift		
Load Life (1,000 hrs)	±20% TRS maximum	
Rotational Life (No Load 50,000 cycles)	±20% TRS maximum	
Rotary Switch Life	25,000 cycles	
Push Momentatry Life	50,000 activations	
Moisture Resistance	±20% TRS	
Mechanical Characteristics		
	32 oz -in (19.8 Nem)	
Stop Strength		
Stop Strength		
Stop Strength	270° ±10°	
Stop Strength		

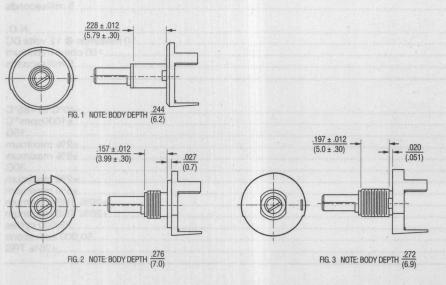


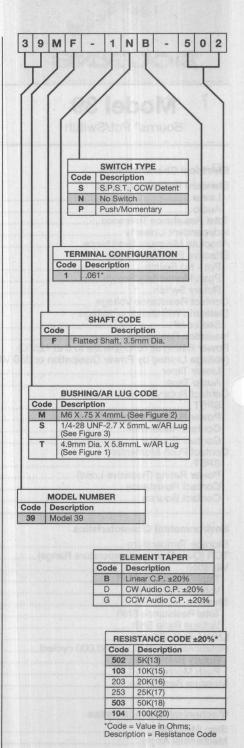
DIMENSIONAL DRAWINGS AND TOLERANCES Model 39





(5.49)





 $3 \times \frac{.236 \pm .008}{(6.0 \pm 0.2)}$



SEALED 1/2" (12.5MM) SQUARE CONTROL

- Conductive plastic or cermet
- Linear and audio tapers
- PC board and bushing mount
- Gangable
- Metal bushing and shaft

Model 50 Series

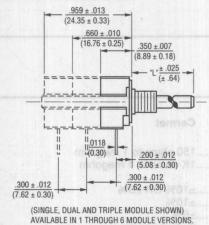
Bourns® Panel Controls

Electrical Characteristics¹	Conductive Plastic	Cermet	
Standard Resistance Range			
	1K ohms to 1 megohm	150 ohms to 1 megohm	
Audio	1K ohms to 1 megohm	1K ohms to 1 megohm	
Total Resistance Tolerance		THE THE TOTAL CO.	
Linear Tapers	±10% OR ±20%	±10% OR ±5%	
Audio Tapers	±10% OR ±20%	±10%	
	±5%		
Absolute Minimum Resistance	2 ohms maximum	2 ohms maximum	
Effective Electrical Angle	270°±5°	270°±5°	
Contact Resistance Variation	2.0%	2.0%	
Dielectric Withstanding Voltage			
Sea Level	1,500 VAC minimum	1,500 VAC minimum	
70,000	500 VAC minimum	500 VAC minimum	
	1,000 megohms minimum		
Power Rating At 70°C (Derate To 0 At 125°		,	
Voltage Limited By Power Dissipation or 35			
	0.5 watt	1.0 watt	
Audio Tapers	0.25 watt	0.5 watt	
Fracking (Multiple Sections)	3 db	3 db	
Environmental Characteristics ¹	(00.9) (02.7) Lee		
	55°C to +125°C	55°C to 1125°C	
CR (Over Storage Temperature Range)	±1,000ppm/°C	±150nnm/°C	
libration (Single Section)	15G	15C	
Total Resistance Shift	±2% maximum	+2% maximum	
	±5% maximum		
	30G		
Total Resistance Shift	+2% maximum	+2% maximum	
Voltage Ratio Shift	±5% maximum	+5% maximum	
	±10% TRS maximum		
	±10% TRS maximum		
CRV @ 25 000 Cycles	±2%	±10%	
Moisture Resistance	±10% TRS	+5% TRS	
TOO COLOR TO TOO COLOR TO COLO	1070 1110		
Mechanical Characteristics	5 in-lb.	5 in-lb.	
Apphysical Apple	5 IN-ID	5 In-Ib.	
Jechanical Angle orque	290° ±5°	290° ±5°	
	0.2 to 2.0 ozin. (0.15 to 1.4Ncm)	0.2 to 2.0 cz -in (0.15 to 1	4 Nom
Running (Dual or Triple Section)	0.5 to 2.5 ozin. (0.15 to 1.4Ncm)	0.5 to 2.5 oz -in (0.15 to 1.	2 Ncm)
Starting (All Sections)	Running torque +0.5 ozin.	Running torque +0.5 oz -in.	O INCITI)
Clarting (viii Ocotions)	(+0.35 Ncm) maximum	(+0.35 Ncm) maximum	100
Weight (Single Section)	5.5 grams	5 5 grame	
Fach Additional Section	3.0 grams	3.0 grams	
erminals	PC pin or solder lug	PC pip or solder lug	
4	Manufacturer's symbol and part numbe	o pin or solder lug	

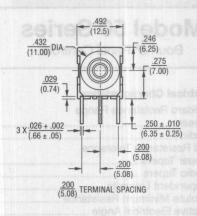


DIMENSIONAL DRAWINGS AND TOLERANCES Model 50 Series

PACKAGE DIMENSIONS

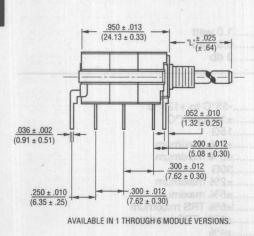


 $\begin{array}{c} 492 \\ (11.00) \text{DIA}. \\ \hline 0.29 \\ (0.74) \\ \hline \end{array}$



SOLDER LUG TERMINALS

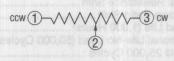
PACKAGE DIMENSIONS PCB MOUNTING BRACKET



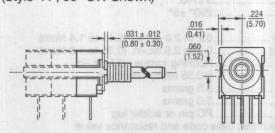
 $\frac{.250 \pm .010}{(6.35 \pm 0.25)}$

ELECTRICAL SCHEMATIC

.071 (1.80)

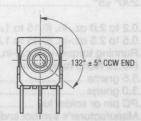


ANTI-ROTATION LUG (Style "A", 90° CW Shown)



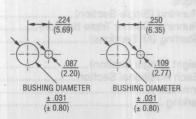
SHAFT FLAT ORIENTATION

 $2 \times \frac{.016 \pm .002}{(.41 \pm .05)}$



SUGGESTED PANEL LAYOUTS The Model 50 can be used with either

The Model 50 can be used with either of the two panel layouts shown below.



FOR TOLERANCES SHOWN: $XX = \pm \frac{.010}{(.25)}$ $XXX = \pm \frac{.005}{(.13)}$ SHAFT DIMENSIONS $\pm \frac{1/32}{(.80)}$

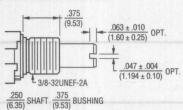
Specifications are subject to change without notice.



DIMENSIONAL DRAWINGS AND TOLERANCES Model 50 Series



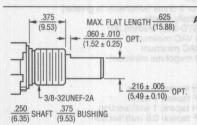
 $\frac{.125}{(3.18)}$ SHAFT $\frac{.250}{(6.35)}$ BUSHING



A Style Bushing

STD. LE	ENGTH 'L'
.500	(12.7)
.625	(15.88)
.750	(19.05)
.875	(22.23)
1.000	(25.4)

STD. LENGTH 'L'
.375 (9.53)
.500 (12.7)
.625 (15.88)
.750 (19.05)
.875 (22.23)
1.000 (25.4)



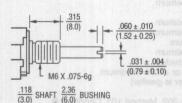
Style Bus	hing -
Flatted	Shaft

STD. L	ENGTH 'L'
.625	(15.88)
.750	(19.05)
.875	(22.23)
1.000	(25.4)

F Style Bushing

	murricum at 1:0 ha	STD
1 (12.70)	$\frac{.031 \pm .010}{(0.79 \pm 0.25)}$ OPT.	.62
	(0.79 ± 0.25)	.75
	1 021 . 004	.87
	$\frac{1}{10000000000000000000000000000000000$	1.00
F L 1/4-32UNEF-2A		
.125 SHAFT .250 BUSHING		

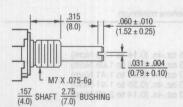
STD. LE	NGTH 'L'
.625	(15.88)
.750	(19.05)
.875	(22.23)
1.000	(25.4)



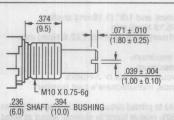
S Style Bushing

STD. LE	NGTH 'L'
.394	(10.0)
.512	(13.0)
.630	(16.0)
.866	(22.0)
.984	(25.0)
	,

U Style Bushing



-	
STD. LI	ENGTH 'L'
.394	(10.0)
.512	(13.0)
.630	(16.0)
.866	(22.0)
.984	(25.0)
A STATE OF THE PARTY OF	THE PERSON NAMED IN

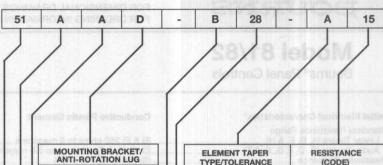


R	Sty	le	Bu	ısh	ing	1
-	TD	11	- 110	TII	61.7	1

STD. LE	ENGTH 'L'
.512	(13.0)
.630	(16.0)
.866	(22.0)
.984	(25.0)

Specifications are subject to change without notice.

HOW TO ORDER



Cod	Description	
A	AR Lug 90°CW	
C	AR Lug 270°CW	
D	No AR Lug or Bracket	
L	Front Bracket	
M	Rear Bracket	
N	Front and Rear Bracket	
141	1,12100	
# SI	CTIONS/DETENTS	
ode	Description	

# 5	ECTIONS/DETENTS
Code Description	
Α	Single No Detent
В	Double No Detent
C	Triple No Detent
D	Quad No Detent
E	Single w/Center Detent
F	Double w/Center Detent
G	Triple w/Center Detent
Н	Quad w/Center Detent
J	Five Section
K	Six Section
L	Five Section w/Detent
M	Six Section w/Detent

BUSHING CONFIGURATION		
Code	Description	
Α	3/8"D x 3/8"L	
С	1/4"D x 1/4"L	
F	1/4"D x 1/2"L	
R	10mmD x 9.5mmL	
S	6mmD x 8mmL	
U	7mmD x 8mmL	

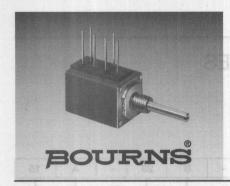
MODEL		
Code	Description	
51	PC Pins (.100" centers)	
52	PC Pins (.200" centers)	
53	Solder Lugs	

ELEMENT TAPER TYPE/TOLERANCE				
Code	Description	VALUE I	IN OHMS	
(A) (H)	Linear Cermet ±10% Linear Cermet ±5%	(28) — 150 (06) — 200 (07) — 250 (08) — 500 (09) — 750 (10) — 1 K (29) — 1.5K (11) — 2K (12) — 2.5K	(13) — 5K (14) — 7.5K (15) — 10K (30) — 15K (16) — 20K (17) — 25K (18) — 50K (19) — 75K (20) — 100I	
(B) (E)	Linear C-P ±20% Linear C-P ±10%	(10) — 1K (12) — 2.5K (13) — 5K (15) — 10K (16) — 20K (17) — 25K	(18) — 50K (20) — 100 (22) — 250 (23) — 500 (25) — 1M	
(C) (F)	CW Audio Cermet ±10% CCW Audio Cermet ±10%	(10) — 1K (12) — 2.5K (13) — 5K (15) — 10K	(17) — 25K (18) — 50K (20) — 100	
(D) (S)	CW Audio C-P ±20% CW Audio C-P ±10%	(10) — 1K (12) — 2.5K (13) — 5K (15) — 10K (17) — 25K	(18) — 50K (20) — 100 (22) — 250 (23) — 500 (25) — 1M	
(G) (T)	CCW Audio C-P ±20% CCW Audio C-P ±10%	(10) — 1K (12) — 2.5K (13) — 5K (15) — 10K (17) — 25K	(18) — 50K (20) — 100 (22) — 250 (23) — 500 (25) — 1M	
M	CW Dual Audio Taper C-P ±20%	(10) — 1K (12) — 2.5K (13) — 5K (15) — 10K (17) — 25K	(18) — 50K (20) — 100 (22) — 250 (23) — 500 (25) — 1M	

	ALL STRUCKS OF METERS	HARRIST LAND.	Contraction of the Contraction	
SHAFT TYPE		AVAILABLE ONLY IN		
		BUSHINGS	LENGTHS	
Code	Description	Code	Description	
Α	Single Plain 1/4"D	Α	20,24,28,32	
В	Single Slotted 1/4"D	Α	12,16,20,24,28,32	
С	Single Flatted 1/4"D	Α	20, 24,28,32	
D	Single Plain 1/8"D	C, F	16,20,24,28,32	
E	Single Slotted 1/8"D	C, F	12,16,20,24,28,32	
R	Single Slotted 6mmD	R	10,13,16,22,25	
T	Single Slotted 4mmD	U	10,13,16,22,25	
U	Single Slotted 3mmD	S	10,13,16,22,25	

LENGTH (FMS)		ONLY IN BUSHING	
Code	Description	Code	
12	3/8"	C	
16	1/2"	A, C	
20	5/8"	A, C, F	
24	3/4"	A, C, F	
28	7/8"	A, C, F	
32	1"	A, C, F	
	Metric		
10	10mm	R, S, U, T	
13	13mm	R, S, U, T	
16	16mm	R, S, U, T	
22	22mm	R, S, U, T	
25	25mm	R, S, U, T	

AVAII ADLE



5/8" (16MM) SQUARE / SINGLE-TURN MODULAR / CERMET / CONDUCTIVE PLASTIC

- Metal shaft and bushing
- Consistent, smooth quality feel
- Up to 4 sections available

FOR DIMENSIONAL DRAWINGS SEE PAGE 247. FOR ORDERING INFORMATION SEE PAGE 249.

Model 81/82

Bourns® Panel Controls

nitial Electrical Characteristics	Conductive Plastic Element	Cermet Element
Standard Resistance Range		(a) (072) 900 a (92) i (1. 15) i (1. 15)
Linear Tapers (A. B. E. & H)	(B & E) 250 ohms to 5 megohms	(A & H) 50 ohms to 5 megohms
Audio Tapers (C. D. F. G. S. & T)	(D, G, S, & T) 1K ohms to 5.0 megohm	(C & F) 1K ohms to 5.0 megohms
esistance Tolerance	(B. D.& G tapers) ±20%	(A. C. & F tapers) ±10%
	(E, S, & T tapers) ±10% (B & E tapers) ±5%	(H taper) ±5%
ndependent Linearity	(B & F tapers) +5%	(A & H tapers) +5%
hsolute Minimum Resistance	2 ohms maximum	2 ohms maximum
ontinuity	Maintained for full mechanical angle	Maintained for full mechanical angle
	240° ±5%	
	±1%	
neoretical Resolution	Essentially infinite	Essentially infinite
	MIL-STD-202, Method 301	
	1,500 VAC minimum	
70,000 Feet	500 VAC minimum	500 VAC minimum
	1,000 megohms minimum	1,000 megohms minimum
ower Rating At 70°C (Voltage Limited By Power issipation or 350 VAC, Whichever Is Less)	Tremes Art events A (20.8)	
+70°C Single Section Assembly	(B & E tapers) 1 watt	(A & H tapers) 2 watts
Br (85) XOS (81)	(D, G, S & T tapers) 0.5 watt (B & E tapers) 0.5 watt/section	(C & F tapers) 1 watt
+70°C Multiple Section Assembly	(B & E tapers) 0.5 watt/section	(A & H tapers) 1 watt/section
	(D. G. S & T tapers) 0.25 watt/section	(C & F tapers) 0.5 watt/section
+125°C	(D, G, S & T tapers) 0.25 watt/section 0 watt	0 watt
oll-on/Roll-off	(B & E tapers) 0.25% maximum	(A & H tapers) 0.5% maximum
	(0.00.1)	(C taper) 0.1% maximum CCW end
	(G. 8. T tapers) 0.1% maximum CW and	(F taper) 0.1% maximum CW end
	(D & S tapers) 0.1% maximum CCW end (G & T tapers) 0.1% maximum CW end (D & S tapers) 0.5% maximum CW end	(C taper) 1.0% maximum CW end
	(D & S tapers) 0.5% maximum CW end (G & T tapers) 0.5% maximum CCW end	(C taper) 1.0% maximum CVV end
Magnetic Control (1921 - 1931) - A-S GODA MA (1931) - 3 - 1	(G & T tapers) 0.5% maximum CCW end	(F taper) 1.0% maximum CCW end
nvironmental Characteristics¹		
torage Temperature Range	55°C to +125°C	55°C to +125°C
emperature Coefficient		
Over Storage Temperature Range	±1,000PPM/°C	±150PPM/°C
ibration (Single Section)	15G	15G
Voltage Ratio Shift	±5% maximum	+5% maximum
Total Resistance Shift	±2% maximum	+2% maximum
	30G	
	±5% maximum	
Total Posistanas Chift	±2% maximum	204 maximum
and Life	1,000 hours	1 000 haura
Iotal Hesistance Sniπ	±10% maximum	±5% maximum
otational Life (No Load)	100,000 cycles	100,000 cycles
Total Resistance Shift	(B & E tapers) 10 ohms or ±12% maximum	10 ohms or ±10% maximum
	(whichever is greater)	(whichever is greater)
	(D, G, S & I tapers) ±20% maximum	
loisture Resistance	MIL-STD-202, Method 103, Condition B	MIL-STD-202, Method 103, Condition B
Total Resistance Shift	(B & F tapers) +10% maximum	+5% maximum (all tapers)
	(D, G, S & T tapers) ±20% maximum	E SIVE D
Insulation Resistance (500 VDC)	(D, G, S & T tapers) ±20% maximum 100 megohms minimum	100 megohms minimum
lechanical Characteristics¹	1000	FOR THE REST OF TH
Single Section	0.2 to 1.5 ozin. (0.14 to 1.06 Ncm)	0.2 to 1.5 oz -in (0.14 to 1.06 Nom)
Dual Section	0.2 to 1.5 ozin. (0.14 to 1.06 Ncm)	0.2 to 1.5 oz -in (0.14 to 1.06 Nom)
Triple Section	0.5 to 2.0 ozin. (0.14 to 1.06 Ncm)	0.5 to 2.0 oz. in (0.25 to 1.44 News)
upping Torque (Leoking Dushings)	0.5 to 2.0 ozin. (0.35 to 1.41 Ncm)	0.5 to 2.0 ozin. (0.35 to 1.41 Ncm)
haft Locking Torque with Locknut	0.2 to 4.0 ozin. (0.14 to 2.82 Ncm)	
U In-Ib. (B & E Busnings)	20 oz-in.	2U oz-in.
top Strength	1/4" (6.35mm) and 1/8" (3.18mm) shafts	1/4" (6.35mm) and 1/8" (3.18mm) shafts -
	4 in -lh (45 19 Ncm) min	4 in -lb (45 19 Ncm) min
	7/8" (19.81mm) shaft -2 inlb. (22.6 Ncm) min.	4 inlb. (45.19 Ncm) min. 7/8" (19.81mm) shaft -2 inlb. (22.6 Ncm) mi
Mechanical Angle	300° ±5°	300° ±5°
/eight (Single Section)	21 grams maximum	21 grams maximum
Fach Additional Section	6 grams maximum	6 grams maximum
	Printed circuit terminals or J-Hooks	Printed circuit terminals or 1 Hooks
erminals	Manufacturer's trademark, wiring diagram, date co	

NOTE: Model 81/82 performance specifications do not apply to units subjected to printed circuit board cleaning procedures.

'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.

Specifications are subject to change without notice.



5/8" (16MM) SQUARE / 10-TURN / MODULAR WIREWOUND OR HYBRITRON® ELEMENT

- Compatible with other members of the Model 80 Series
- The only 10-turn precision potentiometer in a modular panel control package
- Up to 3 sections available

FOR DIMENSIONAL DRAWINGS SEE PAGE 244 AND 248. FOR ORDERING INFORMATION SEE PAGE 249.

Model 83/84

Bourns® Precision Potentiometers

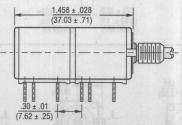
Initial Electrical Characteristics¹	Wirewound Element (J Taper)	Hybriton® Element (K Taper)
	200 to 100K ohms	
	±5%	
Independent Linearity	±0.25%	±0.25%
Effective Electrical Angle	3600° +10°, -0°	3600° +10°, -0°
Minimum Resistance (J Taper)	1.0 ohm or 1% (whichever is greater)	
End Voltage (K Taper)		0.2% of applied voltage
Noise (J Taper)	100 ohms ENR maximum	
Output Smoothness (K Taper)		0.15% maximum
	MIL-STD-202, Method 301	
	1,500 VAC minimum	
	1,000 megohms minimum	
Power Rating (Voltage Limited By Power Di		
		14 × 01 01 01 01 01 01 01 01 01 01 01 01 01
	1 watt	
_+125°C	0 watt	0 watt
Theoretical Resolution	See table	Essentially infinite
Environmental Characteristics¹	是是一种的一种,但是一种的一种,但是一种的一种。	1 (82.2 fac) 1 (1.2 fac)
Storage Temperature Range	55°C to +125°C	55°C to +125°C
Tompovotuvo Coefficient		
Over Storage Temperature Range	±50PPM/°C	±100PPM/°C
Vibration	15G	15G
Winer Bounce	0.1 millisecond maximum	0.1 millisecond maximum
	50G	
Winer Rounes	0.1 millisecond maximum	0.1 millisecond maximum
	1.000 hours	
	±2% maximum	
	1,000,000 shaft revolutions	
Total Resistance Shift	±5% maximum	±5% maximum
	MIL-STD-202, Method 103, Condition B	
	±2% maximum	
Insulation Resistance (500 VDC)	100 megohms minimum	100 megohms minimum
Mechanical Characteristics¹	encepted of the bank of the second of the	《日本教》。 《日本教》, 「日本教》, 「日本教》, 「日本教》, 「日本教》, 「日本教》, 「日本教》, 「日本教育」。 「日本教育」, 「日本教育」, 「日本教育」。 「日本教育」 「日本教育」 「日本教育 日本教教育 日本教育 日本教育 日本教育 日本教育 日本教育 日本教育
Mechanical Angle	3600° +15°, -0°	3600° +15° -0°
Shaft Runout	0.006 in. (0.15mm) T.I.R.	0.006 in (0.15mm) TLR
Shaft End Play	0.014 in. (0.36mm) T.I.R.	0.014 in (0.36mm) TLR
Shaft Radial Play		0.005 in (0.13mm) T.I.R.
Ston Strength		48.0 oz in (33.00 Nom) minimum
vveignt	Approximately 0.75 ozin. (0.53 Ncm)	Approximately 0.75 ozin. (0.53 Ncm)
rerminais	Printed circuit terminals or solder lugs	Printed circuit terminals or solder lugs
Marking	Manufacturer's trademark, wiring diagram,	
	date code and resistance, manufacturer's	date code and resistance, manufacturer's
	part number	part number

Wirewound Resolution Table

Resistance (Ohms)	Resolution (Nom.) (%)
200	.048
500	.037
1K	.032
2K	.031
5K	.023
10K	.020
20K	.015
50K	.012
100K	.010

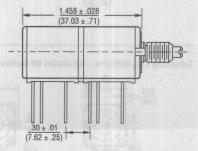
Dimensional Drawings

Dual Section Model 84 Solder Lugs



Note: The Models 83/84 dimensions for dual section assembly are for either single or dual concentric shaft styles.

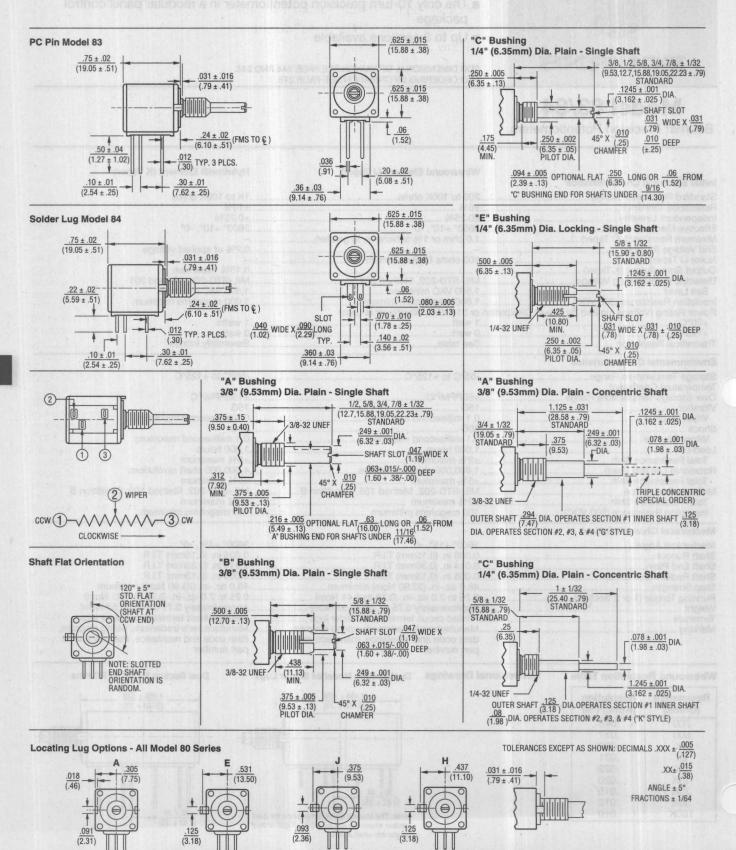
Dual Section Model 83 PC Pins

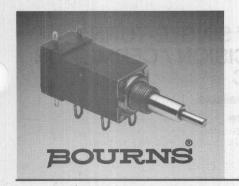


NOTE: Model 83/84 performance specifications do not apply to units subjected to printed circuit board cleaning procedures.
¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
Specifications are subject to change without notice.



DIMENSIONAL DRAWINGS AND TOLERANCES Model 83/84





5/8" (16MM) SQUARE / SINGLE-TURN / ROTARY SWITCH MODULE / CERMET OR CONDUCTIVE PLASTIC

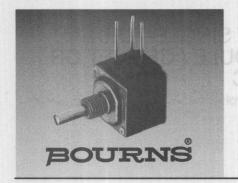
- Designed for "on-off" function control
- Positive action, "non-tease" detent
- Low actuation torque

FOR DIMENSIONAL DRAWINGS SEE PAGE 248. FOR ORDERING INFORMATION SEE PAGE 249.

Model 85/86

Bourns® Panel Controls

Switch specifications listed below.	
Initial Electrical Characteristics	Blandard Resistants Range
Contacts: DPST DPDT	N.O/N.O.,N.C./N.C. or N.O./N.C. 2 N.O./N.C. (break before make)
DPST	1A @ 125 volts RMS-60 Hz or 1A @ 28 VDC10 milliohms nominal5 milliseconds maximum
Dielectric Withstanding Voltage. Sea Level Insulation Resistance	
Environmental Characteristics¹	rumation and 0
Exposure Temperature Range Exposure Temperature Range Vibration (Dual Section) Contact Resistance Contact Bounce Shock (Dual Section) Contact Resistance Contact Bounce Rotational Life Switch Actuating Torque (50% Duty cycle @ Rated Power Load) Contact Resistance Moisture Resistance Contact Resistance Contact Resistance (0.1VDC-10mA) Insulation Resistance (After 24 Hours @ Room Temperature) (500 VDC) Housing Material	65° to +125°C65° to +
Actuating Torque (Each Section, Switch Module Only) Running Torque (Out of Detent, 2-4 Module Assembly) Detent Actuation Angle Contact Materials Terminal Styles	
Standard Orientation	



5/8" (16MM) SQUARE / SINGLE-TURN / MODULAR SEMI-PRECISION / CERMET OR CONDUCTIVE PLASTIC

- Zero base linearity, as low as 1% available
- Exclusive shaft torque control feature
- Up to 4 sections available

FOR DIMENSIONAL DRAWINGS SEE PAGE 247. FOR ORDERING INFORMATION SEE PAGE 249.

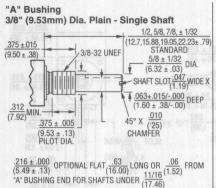
Model 87/88

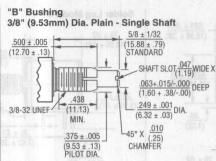
Bourns® Panel Controls

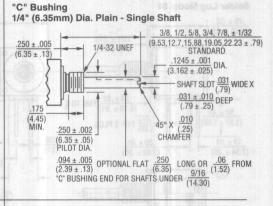
Initial Electrical Characteristics	Conductive Plastic Element	Cermet Element
Standard Resistance Range	(L & N) 250 ohms to 2.5 megohms	(M & P) 250 ohms to 2.5 megohms
	±5%	
	(L) Standard ±2%, (N) Optional 1%	
	2 ohms	
	Maintained for full mechanical angle	
	240° ±4°	
	±1%	
	MIL-STD-202, Method 301	
Sea Level		1 500 VAC minimum
	500 VAC minimum	
	1,000 megohms minimum	
Power Rating (Voltage Limited By Power Diss		
-70°C Multiple Section Assembly	0.5 watt/section	1 watt/conting
+70 C Multiple Section Assembly	0 watt	watt/section
	0 watt	
	Essentially infinite	
Theoretical nesolution	Essentially IIIIIIIte	Essertially illimite
Environmental Characteristics¹		
Tanana anatoma Oa afficiant	55°C to +125°C	
Over Storage Temperature Range	±1,000PPM/°C	±150PPM/°C
Vibration (Single Section)	15G	15G
	±2% maximum	
	±5% maximum	
	30G	
	±2% maximum	
	±5% maximum	
	1,000 hours	
	±10% maximum	
	100.000 cycles	
	10 ohms or ±12% maximum	
Moisture Resistance	(whichever is greater)MIL-STD-202, Method 103, Condition B	MII -STD-202 Method 103 Condition B
Total Resistance Shift	±10% maximum	±10% maximum
Insulation Resistance (500 VDC)	100 megohms minimum	100 megohms minimum
10.8 to 18 oz - ec (6.53 to 10.8 Notes	- Only) (Victima)	
Mechanical Characteristics¹		
Running Torque (Non-Locking Bushings)		significant and the state of th
	0.3 to 1.5 ozin. (0.21 to 1.06 Ncm)	
Single or Dual Section (C & E Bushings)		0.3 to 1.5 ozin. (0.21 to 1.06 Ncm)
Triple Section (All Bushings)	0.5 to 2.0 ozin. (0.35 to 1.41 Ncm)	0.5 to 2.0 ozin. (0.35 to 1.41 Ncm)
	0.5 to 2.0 ozin. (0.35 to 1.41 Ncm)	0.5 to 2.0 ozin. (0.35 to 1.41 Ncm)
Shaft Locking Torque with Locknut	with the finite and another the property of the state of	
@ 10 in-lb. (B & E Bushings)	20 ozin. (14.12 Ncm)	20 ozin. (14.12 Ncm)
Stop Strength	1/4" (6.35mm) and 1/8" (3.17mm) shafts	
		4 inlb. (45.19 Ncm) min.
	.078 in. (0.20mm) shaft - 2 inlb (22.6 Ncm) min.	.078 in. (0.20mm) shaft - 2 inlb. (22.6 Ncm) mir
Mechanical Angle	300° ±5°	300° ±5°
Weight (Single Section)	21 grams maximum	21 grams maximum
Each Additional Section		6 grams maxixmum
Terminals	Printed circuit terminals or J-Hooks	Printed circuit terminals or J-Hooks
	Manufacturer's trademark, wiring diagram,	Manufacturer's trademark, wiring diagram,
	date code, resistance, manufacturer's	date code, resistance, manufacturer's
	part number	part number

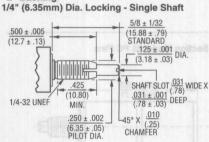


DIMENSIONAL DRAWINGS AND TOLERANCES Model 81, 82, 87, 88

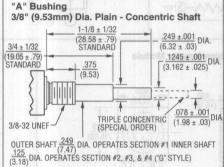


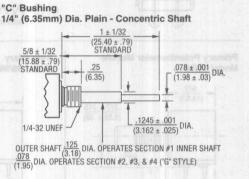


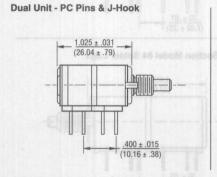




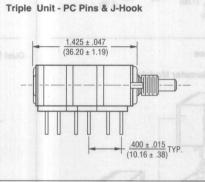
"E" Bushing



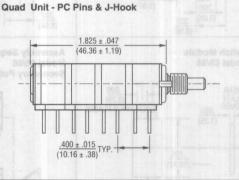


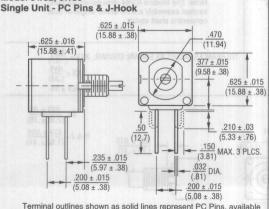


Model 81/82, 87/88

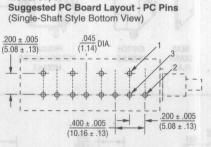


Model 81, 87

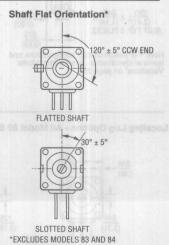




Terminal outlines shown as solid lines represent PC Pins, available on Model 81/87. Dashed line terminal outline represents "J" Hook, available on Model 82/88.

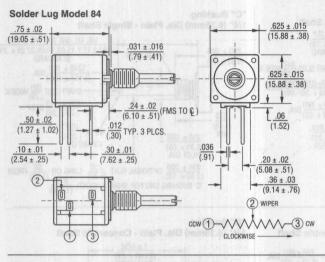


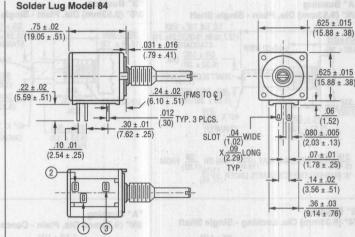
Note: For units with dual concentric shaft styles, a .100 (2.54) spacer is added between the module(s) driven by the outer shaft and those driven by the inner shaft. For G, K, or V shafts, add the spacer between modules 1 and 2. For L or M shafts, add the spacer between modules 2 and 3. For N or P shafts, add the spacer between modules 3 and 4.



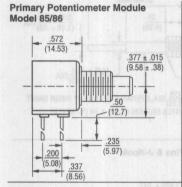


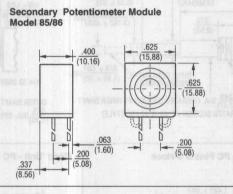
DIMENSIONAL DRAWINGS AND TOLERANCES Model 83, 84, 85, 86



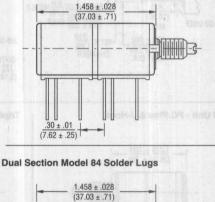


Dual Section Model 83 PC Pins

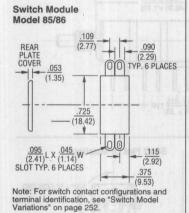


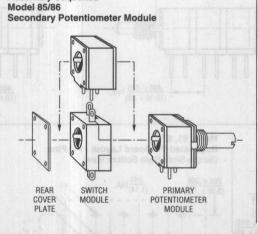


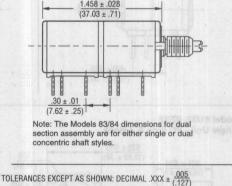
Assembly Sequence

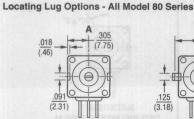


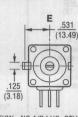
BMHUOB

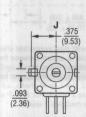


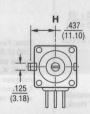


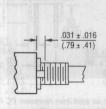












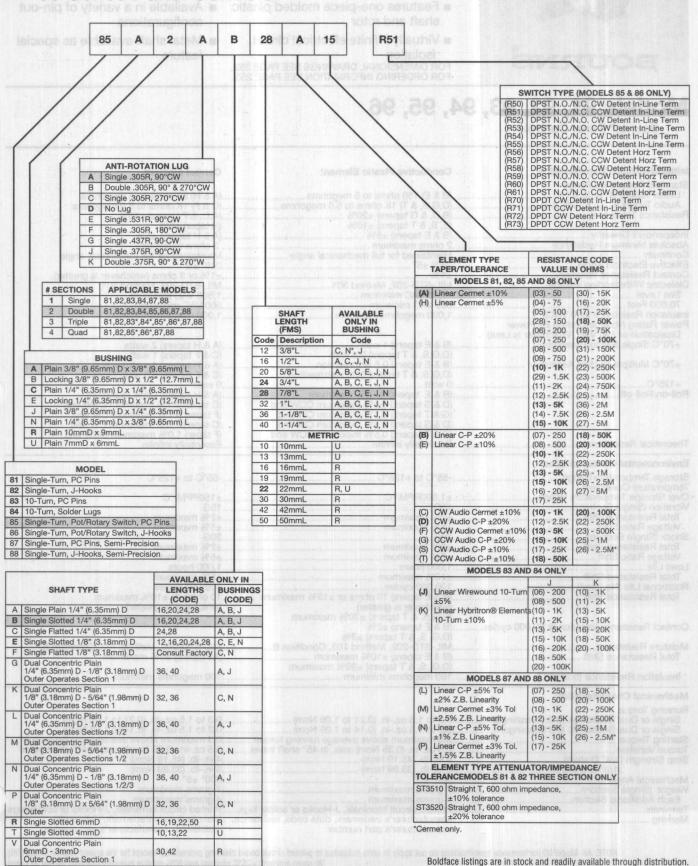
H & J = $\frac{.078 \pm .016}{(1.98 \pm .41)}$

 $.XX \pm \frac{.015}{(.38)}$ ANGLE ± 5%

NOTE: "D" OPTION - NO A/R LUG. OTHER LOCATING LUG OPTIONS AVAILABLE. FOR DETAILS CONSULT FACTORY.



HOW TO ORDER 80 Series Panel Controls



Boldface listings are in stock and readily available through distribution.



5/8" (16MM) SQUARE / SINGLE-TURN / MODULAR / CERMET OR CONDUCTIVE PLASTIC

- Features one-piece molded plastic shaft and rotor
- Virtually infinite electrical circuit isolation

FOR DIMENSIONAL DRAWINGS SEE PAGE 252. FOR ORDERING INFORMATION SEE PAGE 253.

- Available in a variety of pin-out configurations
- Metal shaft available as special feature

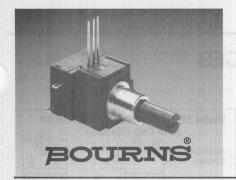
Models 91, 92, 93, 94, 95, 96

Bourns® Panel Controls

Initial Electrical Characteristics¹	Conductive Plastic Element	Cermet Element
Standard Resistance Range		
Linear Tapers (A, B, E, & H)	(B & F) 150 ohms to 5 megohms	(A & H) 50 ohms to 5 megohms
Audio Tapers (C. D. F.G.S. & T)	(D.G.S. & T) 1K ohms to 5.0 megohms	(C & F) 1K ohms to 5 0 megohms
Resistance Tolerance	(B.D. & G tapers) +20%	(A C. & F tapers) +10%
Start Start Start WOO TONG 19750	(F. S. & T tapers) +10%	(H taper) +5%
Independent Linearity	(B & E tapers) +5%	(A & H tapers) +5%
ADSOIULE MINIMUM RESISTANCE	onms maximum	Z ODINS MAXIMUM
Continuity	Maintained for full machanical angle	Maintained for full machanical angle
Effective Electrical Angle	240° ±5°	240° ±6°
Contact Resistance Variation	±1%	±1% or 3 ohms (whichever is greater)
Dielectric Withstanding Voltage	MIL-STD-202, Method 301	MIL-STD-202, Method 301
Sea Level	1,500 VAC minimum	1,500 VAC minimum
	500 VAC minimum	
Insulation Resistance (500 VDC)	1,000 megohms minimum	1,000 megohms minimum
Power Rating (Voltage Limited By Power Dissipation or 350 VAC, Whichever Is Less)	(FMS) BUSHNO	88. C0, 764. C8. 38. 75. 00.01. 5.
+70°C Single Section Assembly	(B & E tapers) 1 watt	(A & H tapers) 2 watts
MODEL AND THE COURT OF THE COUR	(D,G,S, & T tapers) 0.5 watt	(C & F tapers) 1 watt
+70°C Multiple Section Assembly	(B & E tapers) 0.5 watt/section	(A & H tapers) 1 watt/section
	(D,G,S, & T tapers) 0.25 watt/section	(C & F tapers) 0.5 watt/section
+125°C	(B & E tapers) 1 watt	0 watt
Roll-on/Roll-off	(B & E tapers) 0.25% maximum	(A & H tapers) 0.5% maximum
	(D & S tapers) 0.1% maximum CCW end	(C taper) 0.1% maximum CCW end
	(G & T tapers) 0.1% maximum CW end	(F taper) 0.1% maximum CW end
	(D & S tapers) 0.5% maximum CW end	(C taper) 1.0% maximum CW end
	(G & T tapers) 0.5% maximum CCW end	(F taper) 1.0% maximum CCW end
Theoretical Resolution	Essentially infinite	Essentially infinite
Environmental Characteristics¹		
Storage Temperature Range	-55°C to 1125°C	55°C to 1125°C
Temperature Coefficient Over Storage Temperature Range Vibration (Single Section)	+1 000PPM/°C	+150PPM/°C
Vibration (Single Section)	15G	15C
Total Resistance Shift	±2% maximum	+2% maximum
Voltage Ratio Shift	±5% maximum	+5% maximum
Shock (Single Section)	30G	30G
Shock (Single Section) Total Resistance Shift	+2% maximum	+2% maximum
Voltage Batio Shift	±5% maximum	+5% maximum
Load Life	1,000 hours	1 000 hours
	±10% maximum	
Rotational Life (No Load)	100 000 cycles	100 000 cycles
Total Resistance Shift	(B & F tapers) 10 ohms or +15% maximum	10 ohms or +10% maximum
	(which aver in greater)	(unbiglious usu in suspense)
Contact Resistance Variation @ 50,000 cycles	(D.G.S. & T tapers) +20% maximum	(Williams to ground)
Contact Resistance Variation @ 50,000 cycles	(B & E tapers) ±2%	
one van Laure en	(D.G. S. & T tapers) ±3%	
Moisture Resistance	MIL-STD-202, Method 103, Condition B	MIL-STD-202, Method 103, Condition B
IOTAL RESISTANCE SHIT	(B & F tapers) +1(1% maximum	(All faners) +5% maximum
	(D,G, S, & T tapers) ±20% maximum 100 megohms minimum	E Duel Constrainte Paul
Insulation Resistance (500 VDC)	100 megohms minimum	100 megohms minimum
Mechanical Characteristics¹	F. X (4) (4) (4)	DATE OF THE PROPERTY OF THE PR
Mechanical Characteristics¹ Running Torque		
Single or Dual Section (A. D. & r Bushings)	0.3 to 1.5 ozin. (0.21 to 1.06 Ncm)	0.3 to 1.5 oz -in (0.21 to 1.06 Ncm)
Single or Dual Section (C. & I.I Bushings)	0.2 to 1.5 ozin. (0.14 to 1.06 Ncm)	0.2 to 1.5 oz -in (0.21 to 1.00 Ncm)
Starting Torque	0.3 maximum above average running torque	0.3 maximum above average rupping torque
Torque Variation	0.5 oz -in (0.35 Ncm) max in 45° shaft travel	
Stop Strength (1/4" D shaft)	4 in -lb. (45.19 Ncm)	4 in -lh (45 19 Ncm)
(1/8" D shaft)	3 in -lb. (33.89 Ncm)	3 in -lb. (33.89 Ncm)
Mechanical Angle	300° +5°	300° +5°
Weight (Single Section).	7 grams maximum	7 grams maximum
Weight (Single Section) Each Additional Section	4 grams maximum	4 grams maxixmum
Terminals	Printed circuit terminals, J-Hooks or solder lu	ugsFinited circuit terminals, J-Hooks or solder lug nce,Manufacturer's trademark, date code,
Marking	Manufacturer's trademark date code resista	nce Manufacturer's trademark date and

NOTE: All Model 90 performance specifications do not apply to units subjected to printed circuit board cleaning procedures, except for the sealed version (Model 96).

'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.



5/8" (16MM) SQUARE / SINGLE-TURN / ROTARY SWITCH MODULE / CERMET OR CONDUCTIVE PLASTIC

- Designed for "on-off" function control
- Positive action, "non-tease" detent
- Low actuation torque

FOR ORDERING INFORMATION SEE PAGE 253.

Models 97, 98, 99

Bourns® Panel Controls

Switch specifications listed below. For potentiometer specifications see Model 93/94/95, page 250.

Initial Electrical Characteristics ¹	
Contacts:	
DPST	
DPDT	2 N.O./N.C. (break before make)
Power Rating (Resistive Load):	
DPST2A @	
DPDT	
Contact Resistance (.1VDC-10mA)	
Contact Bounce	
Dielectric Withstanding Voltage	
Sea Level	
Insulation Resistance	1000 megohms minimum
Environmental Characteristics ¹	000 520
Operating Temperature Range	0°C to +70°C
Exposure Temperature Range	65° to +125°C
Vibration (Dual Section)	8G
Contact Resistance	10 milliohms maximum
Contact Bounce	0.1 millisecond maximum
Shock (Dual Section)	
Contact Resistance	
Contact Bounce	
Rotational Life	
Switch Actuating Torque (50% Duty cycle @ Rated Power Load)	2 to 7 ozin. (1.41 to 4.94 Ncm)
Contact Resistance	
Moisture Resistance	
Contact Resistance (0.1VDC-10mA)	10 milliohms maximum
Insulation Resistance (After 24 Hours @ Room Temperature) (500 VDC)	100 megohms minimum
Housing Material	High temperature, flame retardant, thermosetting plastic
Mechanical Characteristics¹	- BE TO DESCRIPT TO SERVE
Actuating Torque (Each Section, Switch Module Only)	5 to 15 oz -in (3 53 to 10 59 Nom)
Running Torque (Out of Detent, 2-4 Module Assembly)	0.3 to 2 oz -in (0.21 to 1.41 Ncm)
Detent	
Actuation Angle	
Contact Materials	

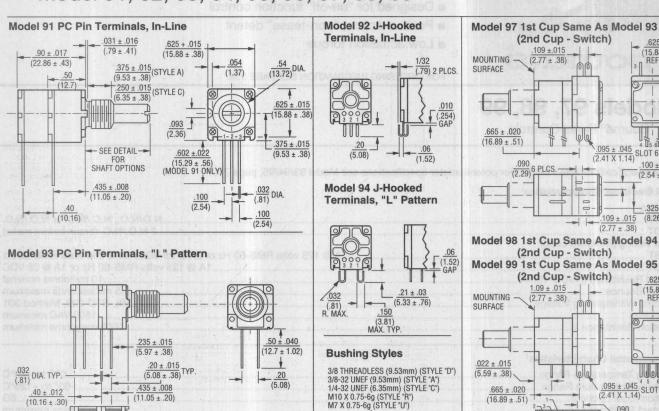
Standard Orientation.....

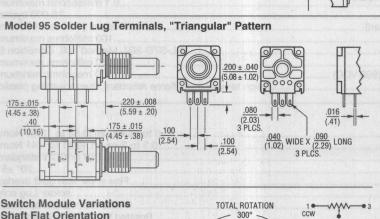
Terminal Strength (Before and After Soldering Heat Exposure)

Terminal Styles

BOURNS

DIMENSIONAL DRAWINGS AND TOLERANCES Model 91, 92, 93, 94, 95, 96, 97, 98, 99



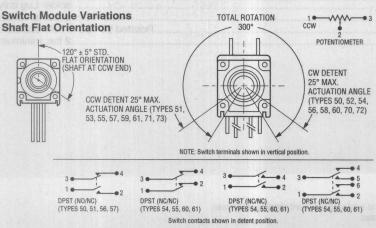


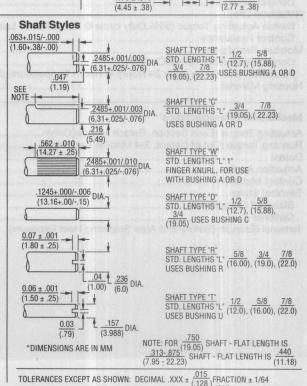
.435 ± .008

 $(11.05 \pm .20)$

.40 ± .012

(10.16 ± .30)





175 ± .015

.XX ± .005 (.38) ANGLE ±5°

(2.41 X 1.14) SLOT 6 PLCS

09 ± .015

 $\frac{.100 \pm .010}{(2.54 \pm .25)}$

.325 ± .010

 $(8.26 \pm .25)$

(15.88) REF.

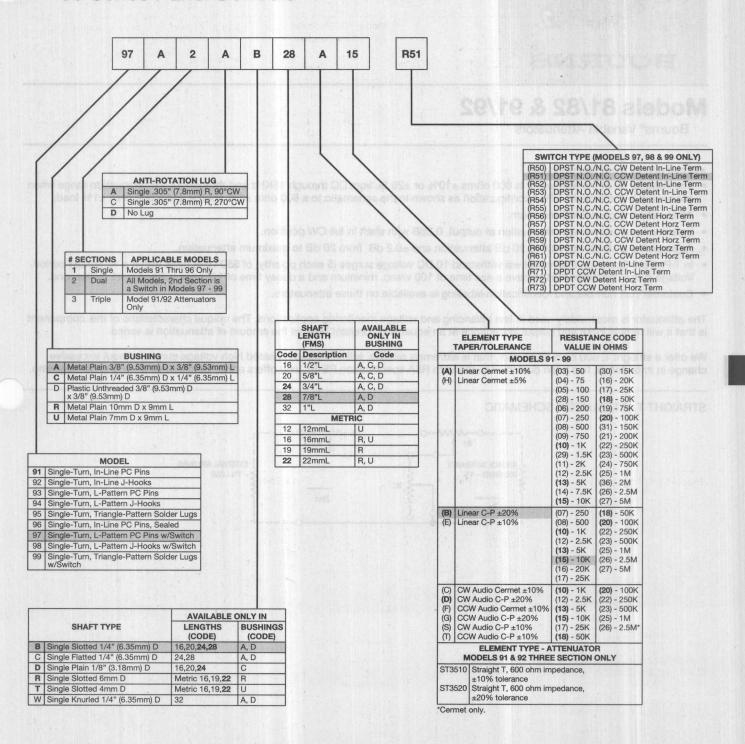
.095 ± .045 SLOT 6 PLCS

.090 (2.29) 6 PLCS

109 ± .015



HOW TO ORDER 90 Series Panel Controls





5/8" (16MM) SQUARE / SINGLE-TURN / MODULAR / VARIABLE ATTENUATORS / STRAIGHT T-PAD

Models 81/82 & 91/92

Bourns® Variable Attenuators

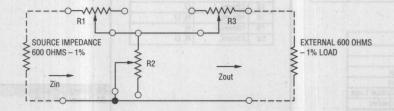
ATTENUATOR SPECIFICATIONS

- The impedance of the attenuator is 600 ohms ±10% or ±20 % from DC through 15KHz and throughout the attenuation range when connected in the straight T-Pad configuration as shown in the schematic to a 600 ohm ±1% source and a 600 ohm ±1% load.
- · Attenuation range is 30dB minimum.
- Insertion loss, or minimum attenuation at output, 0.2dB with shaft in full CW position.
- Adjustability ±1.0 dB from 0.5 to 20 dB attenuation and ±0.2 dB from 20 dB to maximum attenuation.
- In T-Pad configuration this model will withstand 10 DC voltage surges (5 each polarity) of 550 volts peak within a 10 minute period.
 Voltage surge characteristics to have a rise time of 100 v/sec. minimum and a decay time of 1/2 peak voltage in ≥1 millisecond.
- · Customer part number and identification labelling is available on these attenuators.

The attenuator is most widely used in line balancing and voltage monitoring applications. The unique characteristic of this component is that it will remain input and output impedance at an equal and constant level as the amount of attenuation is varied.

We offer a straight T, 600 ohm attenuator, that is extremely reliable, will withstand repeated high voltage surges without excessive change in impedance, has been customer qualified to REA specification PE-61, and offers a truly competitive price and delivery time.

STRAIGHT T ATTENUATOR SCHEMATIC





3/4" (19MM) DIAMETER / CERMET OR CONDUCTIVE PLASTIC

- Single-turn (3851 and 3852)
- 3 -3/4-turn (3856)
- Minimal depth package
- Good resolution

- Linear and audio tapers
- Wide resistance range

FOR ORDERING INFORMATION SEE PAGE 258.

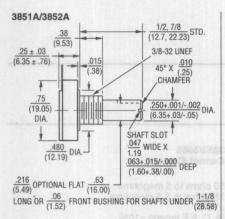
Models 3851/3852/3856

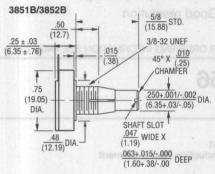
Bourns® Panel Controls

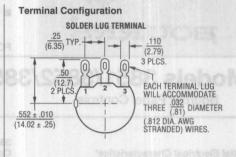
Initial Electrical Characteristics¹	3851 Conductive Plastic Element	3852/3856 Cermet Element
Standard Resistance Range		
	1K to 2.5 megohms	50 ohms to 5 megohms
audio Tapers (C. D. F. and G)	750 ohms to 2.5 megohms	1K ohms to 2.5 megohms
Resistance Tolerance	±20%	+10%
	(B, D, & G tapers) ±20%	
Leto base Linearity	(E topor) +1004	(H taper) +504
adapardant Linearity, TV A N 310, st	(E taper) ±10% ±10%	(A 8 11 topose) : 50/
ndependent Linearity	±10%	(A & H tapers) ±5%
	2 ohms maximum	
	Maintained for full mechanical angle	
	250° ±5°	
Contact Resistance Variation	±1%	±3% of total resistance or 3 ohms
	MIL-STD-202, Method 301	(whichever is greater)
Pielectric Withstanding Voltage	MIL-STD-202, Method 301	MIL-STD-202, Method 301
Sea Level	900 VAC minimum	900 VAC minimum
70,000 Feet	350 VAC minimum	350 VAC minimum
	1,000 megohms minimum	
ower Rating (Voltage Limited By Power		
Dissipation or 316 VAC, Whichever Is Less)		
170°C	(B & E tapers) 1 watt	(A & H tapara) 2 watta
	(D & G tapers) 0.5 watt	(C & F tapers) 1 watt
+125°C	0 watt	ting takes 1 Village Ora
+150°C		0 watt
heoretical Resolution	Essentially infinite	Essentially infinite
nvironmental Characteristics¹		
	65°C to +125°C	-65°C to +150°C
Vor Storage Temperature Pange	±1,000PPM/°C	150DDM/9C
brotion	1,000FFW/ G	£150PPIVI/ C
	20G	
	±2% maximum	
	±5% maximum	
	100G	
	±2% maximum	
Voltage Ratio Shift	±5% maximum	±6% maximum
oad Life	1,000 hours	1.000 hours
Total Resistance Shift	±10% maximum	+3% maximum
totational Life (No Load)	100,000 cycles	50,000 cycles
Total Resistance Shift	±15% maximum	+5% or 5 ohms (whichover is greater)
Agieturo Poeistanco	MIL-STD-202, Method 103, Condition B	MIL CTD 202 Method 102 Condition B
Total Desistance Obit		WIL-STD-202, Method 103, Condition B
Iotal Resistance Snift	±10% maximum	±2% maximum
Insulation Resistance (500 VDC)	100 megohms minimum	100 megohms minimum
for hand and Observe about a time!		TO THE AREA SERVICE
dechanical Characteristics		
	(A & B bushings) .05 to 6.0 ozin	
haft Torque	(A & B bushings) .05 to 6.0 ozin(0.35 to 4.23 Ncm)	
	(0.35 to 4.23 Ncm)	(0.35 to 4.23 Ncm)
haft Torque	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin.	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin.
haft Torque	(0.35 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)
haft Torque	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin.	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin.
haft Torque	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
haft Torque	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm) 5 in -lb (56.5 Ncm)
haft Torque	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
haft Torque	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 5 inlb. (56.5 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
haft Torquetop Strengthlechanical Angle	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 5 inlb. (56.5 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
haft Torquetop Strengthlechanical Angle	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 5 inlb. (56.5 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
haft Torquetop Strengthlechanical Angle	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
haft Torquetop Strengthlechanical Angle	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
haft Torquetop Strengthlechanical Angle	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)
Stop Strength	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm)	(0.35 to 4.23 Ncm) (C & E bushings) 0.3 to 6.0 ozin. (0.21 to 4.23 Ncm) 3856 — 0.15 to 3.0 ozin. (0.11 to 2.12 Ncm)

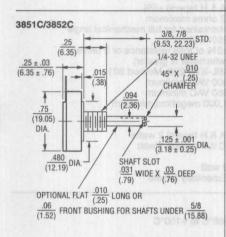


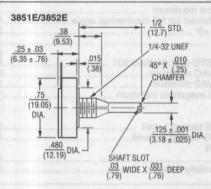
DIMENSIONAL DRAWINGS AND TOLERANCES Model 3851/3852/3856

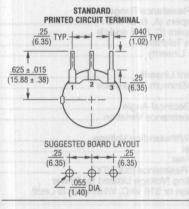


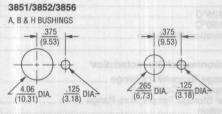


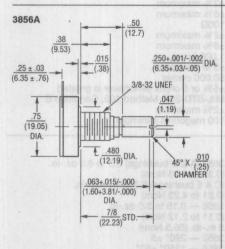


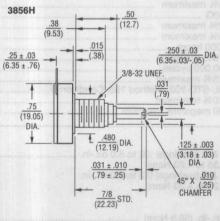


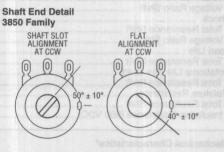












TOLERANCES EXCEPT AS NOTED: DECIMALS: .XXX \pm .005 (.38) FRACTIONS: \pm 1/64 ANGLE: \pm 3%



1/2" (12.7MM) DIAMETER / SINGLE-TURN CERMET

- Small diameter
- Wide resistance range
- Good resolution
- Linear tapers

Model 3862

Bourns® Panel Controls

Initial Electrical Characteristics¹ Resistance Tolerance Contact Resistance Variation..... Theoretical Resolution ... Essentially infinite Dielectric Withstanding Voltage ... MIL-STD-202, Method 301 Sea Level ... 750 VAC minimum .350 VAC minimum Environmental Characteristics¹ Shock Total Resistance Shift Voltage Ratio Shift ±6% maximum Total Resistance Shift Moisture Resistance Total Resistance Shift100 megohms minimum Insulation Resistance (500 VDC) PCB LAYOUT PANEL LAYOUT Mechanical Characteristics¹5 oz.-in. (3.53 Ncm) maximum Weight ... 25 grams maximum Terminals ... Printed circuit pins or J-Hooks Markings.......Mfr's. trademark, wiring diagram, date code, resistance, manufacturer's part number .096 + .005/ - .000 3862E/T 5/8 (15.88) STD. → 3862C/N **Shaft End Detail** 3/8, 7/8 (9.53, 22.23) STD. .035 ± .010 $453 \pm .016$.035 ± .010 (11.51 ± .41) 2 PLCS 45° ± 5° X .016

-32 UNEF - 2A OPTIONAL FLAT (6.35) LONG OR (3.3) 5/8 (16.88)

 $L = \frac{.250}{(6.35)}$ FOR "C" BUSHING, $\frac{.380}{(9.65)}$ FOR "N" BUSHING

POSITION OF SLOTS VARIABLE

 $L = \frac{.375}{(9.53)}$ FOR "T" BUSHING, $\frac{.500}{(12.7)}$ FOR "E" BUSHING

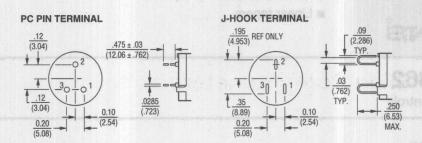
.031 ± .010

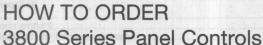
32-1/2° ± 10° FLAT ORIENTATION @ CCW END SLOTS ARE NOT ORIENTED

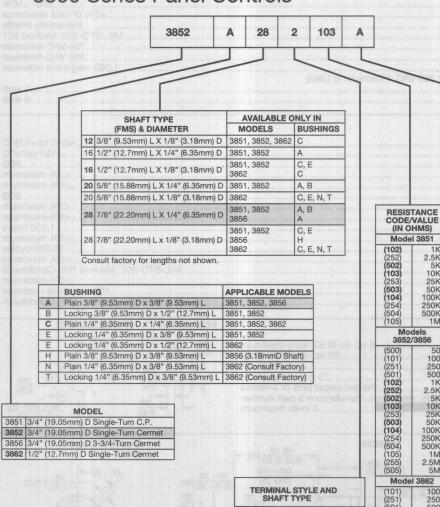
C OF LUG



DIMENSIONAL DRAWINGS AND TOLERANCES 3800 Series Panel Controls







6 (3.	18mmD Shaft)	(500)	50 100
	onsult Factory)	(251)	250
2 (C	onsult Factory)	(501) (102)	500 1K
1 X (1 X)	id text along the part of the form of the	(252) (502) (103) (253) (503) (104) (254) (504) (105) (255)	2.5K 5K 10K 25K 50K 100K 250K 500K 1M 2.5M
	010 = 800	(505)	5M
	102 ± 200 (EA ± 20)	(505)	
1	TERMINAL STYLE AND SHAFT TYPE	(505) Mode (101) (251)	5M 1 3862 100 250
1	SHAFT TYPE Solder Lugs*, Plain End	(505) Mode (101) (251) (501)	5M 1 3862 100 250 500
1 2	SHAFT TYPE Solder Lugs*, Plain End Solder Lugs*, Slotted End	(505) Mode (101) (251) (501) (102) (252)	5M 1 3862 100 250 500 1K 2.5K
1 2 3	SHAFT TYPE Solder Lugs*, Plain End Solder Lugs*, Slotted End Solder Lugs*, Flatted Shaft	(505) Mode (101) (251) (501) (102) (252) (502)	5M 1 3862 100 250 500 1K 2.5K 5K
1 2 3 5	SHAFT TYPE Solder Lugs*, Plain End Solder Lugs*, Slotted End Solder Lugs*, Flatted Shaft PC Pins, Plain End	(505) Mode (101) (251) (501) (102) (252) (502) (103) (253)	5M 1 3862 100 250 500 1K 2.5K 5K 10K 25K
1 2 3	SHAFT TYPE Solder Lugs*, Plain End Solder Lugs*, Slotted End Solder Lugs*, Flatted Shaft	(505) Mode (101) (251) (501) (102) (252) (502) (103)	5M 13862 100 250 500 1K 2.5K 5K 10K

10K 25K 50K 100K

250K 500K 1M

1	ELEMENT TAPER/TOLERANCE	APPLICABLE MODELS
Α	Linear ±10%	3852, 3856, 3862
В	Linear ±20%	3851
C	Audio CW ±10%*	3852, 3856
D	Audio CW ±20%*	3851
E	Linear ±10%	3851
F	Audio CCW ±10%*	3852, 3856
G	Audio CCW ±20%*	3851
Н	Linear ±5%	3852, 3856, 3862

1000 ohms to 2.5 megohms.

Boldface listings are in stock and readily available through distribution. Specifications are subject to change without notice.



10, 15, 20, AND 30MM STROKE LENGTH / LOW PROFILE

- Minimal installation space for maximum design flexibility
- Linear or audio taper versions
- Wide assortment of options

Open-Frame Slide Potentiometers

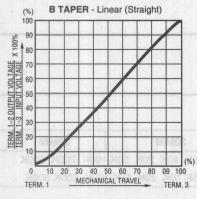
Bourns® Slide Potentiometers

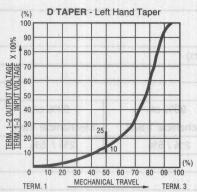
Electrical Characteristics	10MM	15MM	20MM	30MM				
Standard Resistance RangeLinear	1K 2K 5K 10K 2	20K 50K 100K 200K	2K 5K 10K 20K 50K	100K 200K 500K				
(ohms) Audio	2K 5K 10K 2	20K 50K 100K 200K	5K 10K 20K 50K	100K 200K 500K				
Resistance Tolerance	±20%, All Resistance	ce/Tapers						
Resistance TaperLinear	B and Y Tapers (see	taper curves)	THE PERSON NAMED IN COLUMN	and a respective of the control of t				
Audio	D and G Tapers (see	e taper curves)						
Independent Linearity	±5% for B Tapers (s	ee curves for Y, D and C	G tapers)					
Absolute Minimum Resistance	1% or 100 ohms, wh	1% or 100 ohms, whichever is less, for B taper						
Continuity	Maintained for full st	Maintained for full stroke						
Effective Electrical Travel	80% of 85% of 90% of 90% of Mechanical Travel							
Peak Noise (CRV) Linear/Audio	3% / 6%	2% / 5%	2% / 5%	2% / 5%				
Theoretical Resolution	Essentially Infinite	800 ± 810						
Dielectric Strength (Sea Level)	500 VAC, 1 minute, between Lever and Terminals							
Insulation Resistance (500 VDC)	1,000 megohms mir	nimum between Lever a	nd Terminals					
Power Rating at 70°CLinear	0.05 Watt	0.05 Watt	0.1 Watt	0.1 Watt				
(0 Watt at 90°C) Audio	0.025 Watt	0.025 Watt	0.05 Watt	0.05 Watt				
Maximum Working Voltage	Power Dissipation o	r 350 VAC, whichever is	less					
Tracking Error (Dual Only)	4 dB maximum; 0 to	-40 dB						
Environmental Characteristics	10 8	truoté isoths						
Storage Temperature	20°C to +90°C							
Temperature Coefficient of Resistance	±1,000ppm/°C							
Vibration (10 to 55 Hz, 1.5mm)	Voltage Ratio Chang	ge: ±5% maximum. Tota	Resistance Shift: ±2%	maximum				
Load Life	(Pre-conditioning: 55	5°C, 20% RH, 24 ± 4 Ho	ours)	70 05 00 00 07 0 A:00:44:000				
(Rated Power at 25°C for 1,000 Hours)	Total Resistance Shi	ift: ±10%						
Sliding Life	Total Resistance Shi	ift: ±5% = Linear; 2K, 5	K, 10k, 20K, 50K,	HERMIT Y				
(No Load - 15,000 Cycles)		±10% = Linear; 100h	K, 200K, 500K, & Audio;	2K to 500k				
Moisture Resistance (96 Hours @ 40°C	Total Resistance Shi	ft: Linear ±12% maximu	um, Audio ±20% maximu	um				
90-95% RH, Rated Power)	Insulation Resistanc	e: 100 megohms minim	um					
Soldering Heat (3 Seconds @ 350°C)	Total Resistance Shi	ft: ±5% maximum						
Mechanical Characteristics								
Operating Force	15 to 150 Gr	His War and		and the second				
Stop Strength	1.5 Kg minimum							
Stroke	10mm	15mm	20mm	30mm				
Terminals	PC Pins (Vertical or I	Horizontal)	LAKE, APPLIE					
Markings	Trademark, date coo	de, taper, and resistance	(ex. B10K) and Japan					

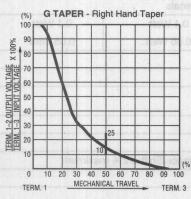


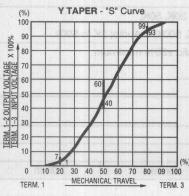
DIMENSIONAL DRAWINGS AND TOLERANCES Bourns® Slide Potentiometers

TAPER CURVES

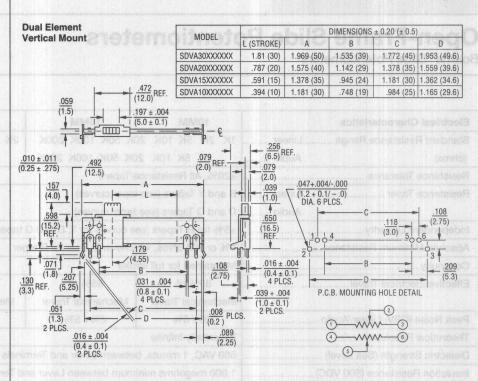


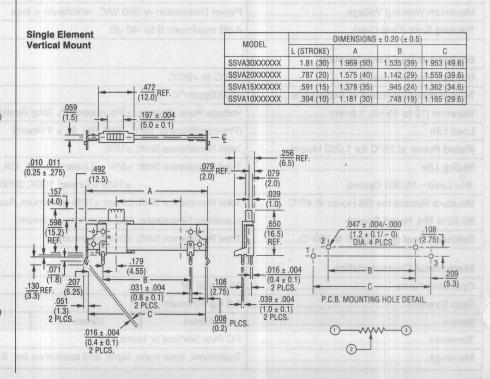






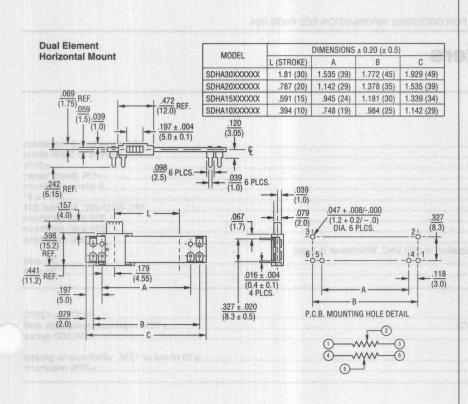
OUTLINE AND DIMENSIONAL DRAWINGS (Dimensions Shown in Brackets are in Millimeters)

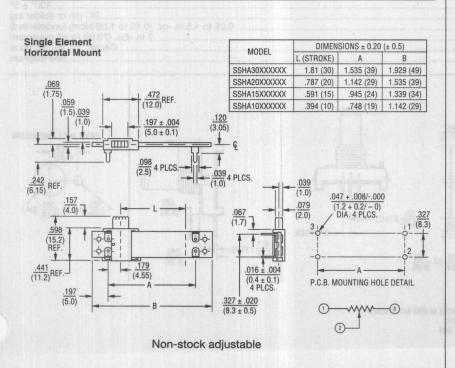


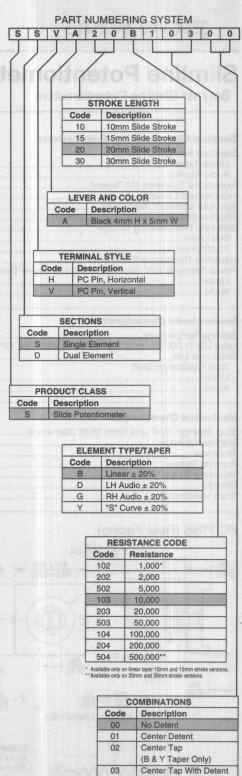




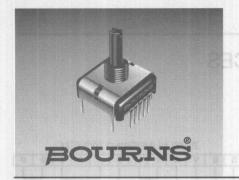
DIMENSIONAL DRAWINGS AND TOLERANCES Bourns® Slide Potentiometers







(B & Y Taper Only)



LOW COST POTENTIOMETER CONDUCTIVE PLASTIC

- Space saving design
- PC pin or solder lug terminals
- Mounting brackets available
- Linear or audio taper versions
- Wide range of resistance values
- Metric shaft and bushing option

FOR ORDERING INFORMATION SEE PAGE 264.

Slimline Potentiometers

Bourns® Slimline Potentiometers

Electrical Characteristics - Potentiometer

	Standard Resistance Range
	Linear Tapers
1K ohms to 500K ohms	Audio Tapers.
+20%	Resistance Tolerance (All Tapers)
±5% (linear taper)	Independent Linearity
	Absolute Minimum Resistance
270° ± 5°	Effective Electrical Angle
MII -STD-202, Method 301	Dielectric Withstanding Voltage
1,000 VAC minimum	Sea Level
500 VAC minimum	70.000 Feet
	Insulation Resistance (500 VDC)
	Power Rating @ 70°C (Voltage Limited by Power Dissipation or 350)
.75 watt	

Environmental Characteristics

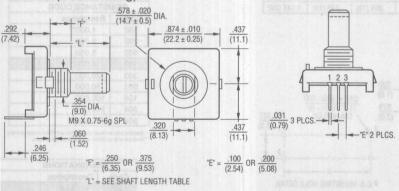
Storage Temperature	-40°C to +125°C
Load Life (1,000 Hours @ Rated Power, 20% RH, 70°C)	
Rotational Life	
Total Resistance Shift	O=-WWO ID 2 NOTE 그는 데 그런 이 프리네이 하다 중에도 뭐 하면 보다.
Linear	+10 ohms or 12% whichever is greater

Mechanical Characteristics

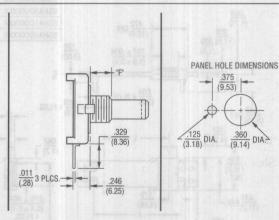
Audio.....

Stop Strength (1/4" and 6mm Shaft Diameters)	7 inlb. (79.09 Ncm)
Mechanical Angle	300° ± 5°
Terminals	PC pin or solder lug
Running Torque	
Mounting Torque	7 inlbs. (79.09 Ncm) maximum
Detents	
Shaft Variations	See diagram

PC PINS (Rear Facing)



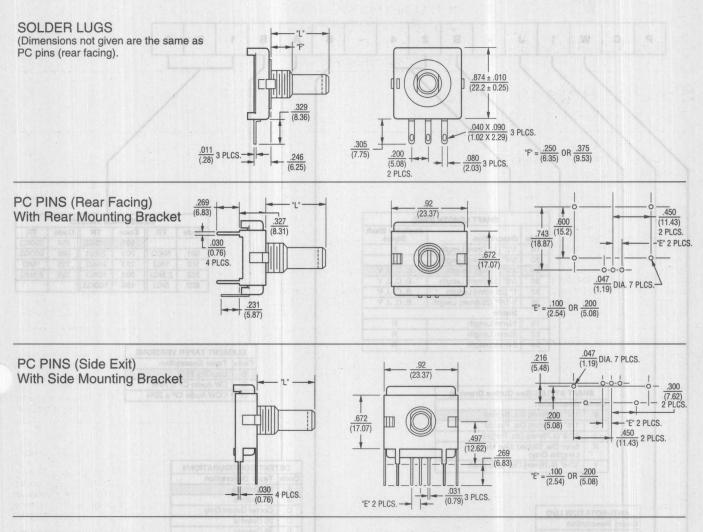




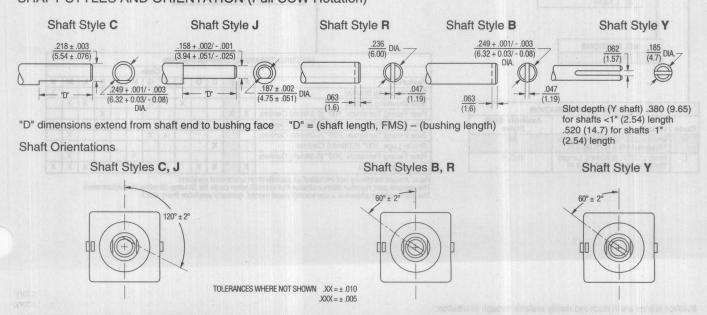
..±20% maximum



DIMENSIONAL DRAWINGS AND TOLERANCES Bourns® Slimline Potentiometers

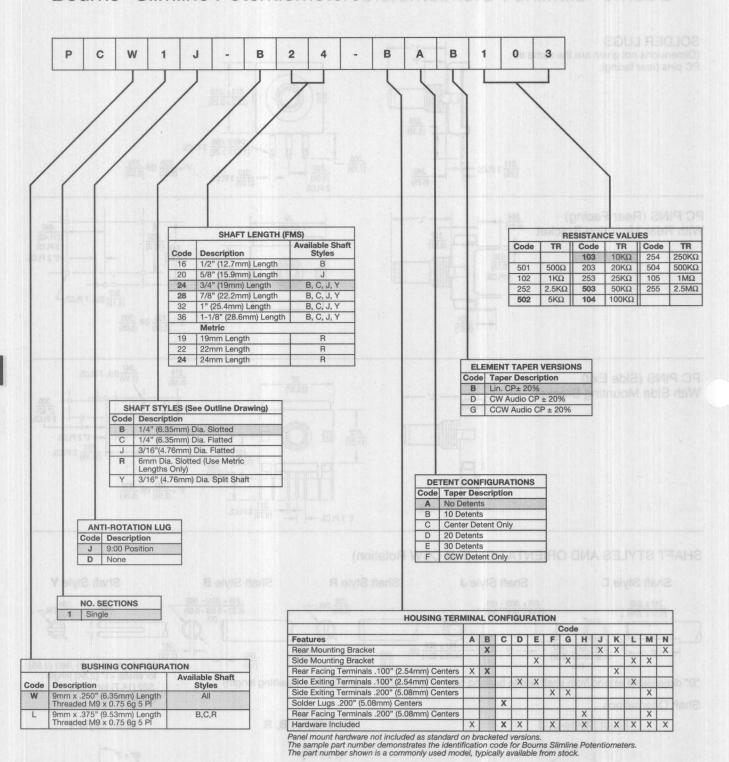


SHAFT STYLES AND ORIENTATION (Full CCW Rotation)





HOW TO ORDER TO MAKE THE REPORT OF THE REPOR





Precision Potentiometers

1.	Product Selection Guide	266
II.	Potentiometers Multiturn	269
	Single-Turn	278
III.	Ordering Information/Resolution Tables	296
IV.	Definitions & Test Procedures	301
V.	Turns-Counting Dials	321





PRODUCT SELECTION GUIDE Multiturn Precision Potentiometers

Model No.	Turns	Element Type	Resistance Tolerance	Resistance Range (Ohms)	Standard Linearity	Pkg. Dia.	Pkg. Depth	Shaft Dia./Length	Mount	Page No.
3400	10	Wirewound	±3%	100-500K	±0.15%	1-13/16" (30mm)	1-3/4" (46mm)	1/4" X 13/16" (6 X 21mm)	Bushing	269
3500	10	Wirewound	±3%	50-100K	±0.20%	7/8" (22mm)	1" (25mm)	1/4" X 13/16" (6 X 21mm)	Bushing	270
3501	10	Hybritron®	±10%	1K-100K	±0.25%	7/8" (22mm)	1" (25mm)	1/4" x 13/16" (6 X 21mm)	Bushing	270
3540	10	Wirewound	±5%	100-100K	±0.25%	7/8" (22mm)	3/4" (19mm)	1/4" X 13/16" (6 X 21mm)	Bushing	271
3541	10	Hybritron®	±10%	1K-100K	±0.25%	7/8" (22mm)	3/4" (19mm)	1/4" X 13/16" (6 X 21mm)	Bushing	271
3543	3	Wirewound	±5%	20-50K	±0.25%	7/8" (22mm)	3/4" (19mm)	1/4" X 13/16" (6 X 21mm)	Bushing	272
3545	5	Wirewound	±5%	50-50K	±0.25%	7/8" (22mm)	3/4" (19mm)	1/4" X 13/16" (6 X 21mm)	Bushing	272
3550	10	Wirewound	±3%	100-200K	±0.2%	7/8" (22mm)	1-9/16" (40mm)	1/8" X 3/8" (3 X 10mm)	Servo	273
3551	10	Hybritron®	±10%	1K-100K	±0.25%	7/8" (22mm)	1-9/16" (40mm)	1/8" X 3/8" (3 X 10mm)	Servo	273
3560	3	Wirewound	±3%	50-50K	±0.25%	7/8" (22mm)	1-1/16" (27mm)	1/8" X 3/8" (3 X 10mm)	Servo	274
3561	3	Hybritron®	±10%	500-20K	±0.25%	7/8" (22mm)	1-1/16" (27mm)	1/8" (3 X 10mm)	Servo	274
3590	10	Wirewound	±5%	200-100K	±0.25%	7/8" (22mm)	3/4" (19mm)	Various	Bushing	275
3700	10	Wirewound	±5%	100-100K	±0.25%	1/2" (13mm)	1" (25mm)	3/32" X 11/16" (2 X 17mm)	Bushing	276
3701	10	Hybritron®	±10%	1K-100K	±0.25%	1/2" (13mm)	1" (25mm)	3/32" X 11/16" (2 X 17mm)	Bushing	276
3750	10	Wirewound	±5%	100-100K	±0.25%	1/2" (13mm)	1-3/16" (30mm)	3/32" X 3/8" (2 X 10mm)	Servo	277
3751	10	Hybritron®	±10%	1K-100K	±0.25%	1/2" (13mm)	1-3/16" (30mm)	3/32" X 3/8" (2 X 10mm)	Servo	277



PRODUCT SELECTION GUIDE Single-Turn Precision Potentiometers Single-Turn Precision Potentiometers

Model No.	Element Type	Resistance Tolerance	Resistance Range (Ohms)	Standard Linearity	Pkg. Dia.	Pkg. Depth	Shaft Dia./Length	Mount	Page No.
3435	Wirewound	±3%	50-50K	±0.5%	1-1/16" (27mm)	11/16" (17mm)	1/8" X 7/8" (3 X 22mm)	Bushing	279
3437	Wirewound	±5%	50-50K	±0.5%	1-1/16" (27mm)	2-3/32" (18mm)	1/4" X 7/8" (6 X 22mm)	Bushing	278
3437H-HYB	Hybritron®	±10%	200-20K	±0.5%	1-1/16" (27mm)	2-3/32" (18mm)	1/4" X 7/8" (6 X 22mm)	Bushing	278
3465	Wirewound	±3%	50-100K	±0.3%	2" (51mm)	1-3/16" (21mm)	1/4" X 5/8" (6 X 17mm)	Servo	280
6534	Conductive Plastic	±10%	1K-100K	±0.5%	7/8" (22mm)	15/32" (12mm)	1/8" X 1/2" (3 X 13mm)	Servo	281
6537	Conductive Plastic	±10%	1K-100K	±1%	7/8" (22mm)	1/2" (13mm)	1/8" X 1/2" (3 X 12.7mm)	Servo	282
6538	Conductive Plastic	±10%	1K-100K	±1%	7/8" (22mm)	19/32" (15mm)	1/8" X 1/2" (3 X 12.7mm)	Servo	282
6539	Conductive Plastic	±15%	1K-100K	±2%	7/8" (22mm)	19/32" (15mm)	1/8" X 1/2" (3 X 12.7mm)	Servo	283
6544	Conductive Plastic	±10%	1K-100K	±0.5%	1-1/16" (27mm)	1/2" (13mm)	1/8" X 1/2" (3 X 13mm)	Servo	284
6574	Conductive Plastic	±10%	1K-100K	±0.1%	2" (51mm)	19/32" (15mm)	1/4" X 7/8" (6 X 22mm)	Servo	285
6575	Conductive Plastic	±10%	1K-100K	±0.1%	2" (51mm)	19/32" (15mm)	1/4" X 5/8" (6 X 17mm)	Servo	286
6637	Conductive Plastic	±10%	1K-100K	±1%	7/8" (22mm)	9/16" (14mm)	1/8" X 7/8" (3 X 22mm)	Bushing	287
6638	Conductive Plastic	±10%	1K-100K	±1%	7/8" (22mm)	21/32" (17mm)	1/8" X 7/8" (3 X 22mm)	Bushing	287
6639	Conductive Plastic	±15%	1K-100K	±2%	7/8" (22mm)	21/32" (17mm)	1/4" X 7/8" (6 x 22mm)	Bushing	283
6657	Conductive Plastic	±10%	1K-100K	±1%	1-5/16" (33mm)	25/32" (20mm)	1/4" X 7/8" (6 X 22mm)	Bushing	288
6674	Conductive Plastic	±10%	1K-100K	±0.25%	2" (51mm)	19/32" (15mm)	1/4" X 7/8" (6 X 22mm)	Bushing	289



PRODUCT SELECTION GUIDE Knobpot® Precision Potentiometers Knobpot® Precision Potentiometers

Model No.	Turns	Element Type	Resistance Tolerance	Resistance Range (Ohms)	Accuracy	Pkg. Dia.	Pkg. Depth	Shaft Dia./Length	Mount	Page No.
3600	10	Wirewound	±5%	100-100K	See Data Sheet	3/4" (19mm)	See Data Sheet	N/A	Bushing	290
3610	10	Wirewound	±5%	100-100K	See Data Sheet	7/8" (22mm)	See Data Sheet	N/A	Snap-in	291
3640	10	Wirewound	±3%	100-250K	See Data Sheet	1-1/4" (32mm)	See Data Sheet	N/A	Bushing	292
3650	10	Wirewound	±3%	100-100K	See Data Sheet	1-1/4" (32mm)	See Data Sheet	N/A	Single	293

Digital Pushbutton Potentiometers

Model No.	Digits	Element Type	Resistance Tolerance	Resistance Range (Ohms)	Accuracy	Pkg. Dia.	Pkg. Depth	Shaft Dia./Length	Mount	Page No.
		(mnuc)	7(E) (mmE	27 mm) = 1 (1	See	See	See	Dilen!		
3680	15	Cermet	±3%	50-1 Meg	Data Sheet	Data Sheet	Data Sheet	N/A	Snap-in	294

Turns-Counting Dials

Model No.	Turns	Approximate Package Diameter	Approximate Package Depth	Page No.
CT-23	815 X *515 0-10 STE	1-1/16" (27mm)	1-1/4" (31.5mm)	322
CT-26	0-10	1-1/4" (28mm)	1-1/4" (31.5mm)	322
MD-50	(2010 X 8) 0-10(105) (m	1-1/8" (28mm)	1-1/4" (33mm)	323
CT-50	8.7 X 14.1 0-10 Mer	1" (25mm)	1-3/8" (33.9mm)	324
CT-46	0-20	1-13/16" (46mm)	1" (25.4mm)	325
H-46	0-20	1-13/16" (46mm)	1" (24mm)	326
H-490	0-30	1" (25mm)	1-3/8" (34mm)	327
H-506	0-15	7/8" (22mm)	1" (25.0mm)	328
H-507-6	0-15	7/8" (22mm)	1" (25.0mm)	329
H-22	0-15	7/8" (22mm)	1" (25.0mm)	330



1-13/16" (44MM) DIAMETER / 10-TURN WIREWOUND

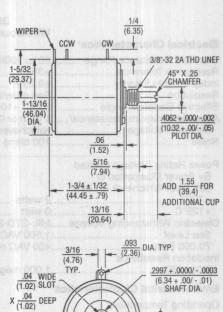
- Bushing mount
- Optional ±0.05 linearity option
- Excellent wiper stability
- High stop strength
- Sealable

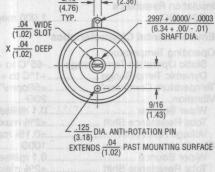
FOR ORDERING INFORMATION SEE PAGE 296.

Model 3400

Bourns® Precision Potentiometers

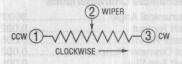
1-H108510-2008	1028 3400	
Electrical Characteristics¹ Standard Resistance Range	1-13/16" Bushing Mount	
Standard Resistance Range	100 to 500K ohms	
Resistance Tolerance	±3%	
Independent Linearity	±0.15%	
Resolution	See ordering information	
Effective Electrical Angle	3600° +4°, -0°	
Absolute Minimum Resistance1 ohm or 0.1	5% maximum (whichever is greater)	
Noise	100 ohms ENR maximum	
Power Rating (Voltage Limited By Power Dissipation	n, or(40°C) 5 watts	
1.000 VAC. Whichever Is Less)	(125°C) 0 watt	
Dielectric Withstanding Voltage	MIL-STD-202, Method 301	
Sea Level	1,000 VAC minimum	
80,000 Feet	300 VAC minimum	
Insulation Resistance (500 VDC)	1,000 megohms minimum	
Environmental Characteristics¹		
Operating Tomporature		
Static Operation Temperature Range	-65°C to +125°C	
Dynamic Temperature Range	+1°C to +125°C	
Temperature Coefficient ²	+20ppm/°C maximum/unit	
Moisture ResistanceMIL	-STD-202 Method 103 Condition B	
Total Resistance Shift		
Vibration		
Wiper Bounce		
Total Resistance Shift		
Voltage Ratio Shift	±0.1% maximum	
Shock	50G	
Wiper Bounce		
Total Resistance Shift		
Voltage Ratio Shift	±0.1% maximum	
Load Life		
Total Resistance Shift	±2% maximum	
Rotational Life (No Load)		
Total Resistance Shift		
Mechanical Characteristics		
Mechanical Angle	3600° +4°0°	
Shaft Runout		
Shaft End Play		
Shaft Radial Play		
Pilot Diameter Runout	0.002 in. (0.05mm) T.I.R.	
Lateral Runout	0.005 in. (0.13mm) T.I.R.	
Stop Strength	550 ozin. (388 Ncm) minimum	
Torque (Starting & Running)	2.0 ozin. (1.4 Ncm) maximum	
Backlash	1.0° maximum	
Weight		
Terminals	Gold-plated solder lugs	
MarkingsManufacturer's nam		
	tolerance, wiring diagram, date code	
Ganging	2 auma mavimuum	



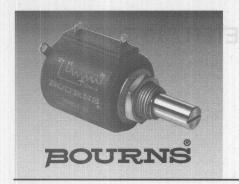


NOTE: LOCKWASHER AND HEX NUT TO BE SUPPLIED WITH EACH UNIT.

TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{(.25)}$, $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$



¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
²Consult manufacturer for complete specification details for resistances below 500 ohms and above 100K ohms.
Specifications are subject to change without notice.



7/8" (22MM) DIAMETER / 10-TURN / WIREWOUND AND HYBRITRON® ELEMENT

- Bushing mount
- Sealable The Se
- Non-standard features and specifications available
- Optional high torque feature
- Optional center tap feature
- Gangable

FOR ORDERING INFORMATION SEE PAGE 296.

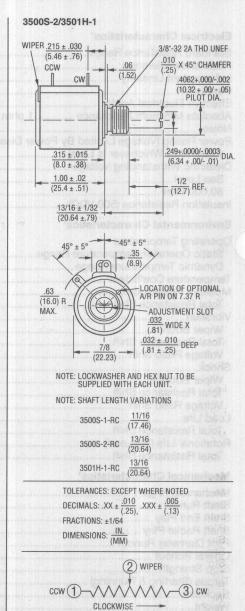
Model 3500/3501

Bourns® Precision Potentiometers

	3500 Wirewound Element	3501 Hybritron® Element
Electrical Characteristics	BOOK ohme	
Standard Resistance Range	50 to 100K ohms	1K to 100K ohms
Resistance Tolerance	±3%	±10%
Independent Linearity	±0.20%	±0.25%
Resolution	See ordering information	Essentially infinite
Effective Electrical Angle	3600° +10°, -0°	3600° +10°, -2°
Absolute Minimum Resistance/	1 ohm or 0.1% maximum	Minimum voltage 0.2%
Minimum Voltage	(whichever is greater)	maximum
Noise		
		maximum
Power Rating (Voltage Limited		1 Startile IM
By Power Dissipation or	properties 3	
325 VAC, Whichever Is Less)	auminim O	AV 000
+/0°C	2 watts	2 watts
+125°U	0 watt	U watt
Dielectric Withstanding Voltage	MIL-STD-202, Method 301	WIL-STD-202, Method 301
70 000 Foot	1,500 VAC minimum	1,500 VAC minimum
Insulation Resistance	400 VAC minimum	400 VAC minimum
(500 VDC)	1,000 megohms minimum	1 000 magahma minimum
Environmental Characterist		
Operating Temperature		
	65°C to +125°C	
	+1°C to +125°C	
Temperature Coefficient ²	±50ppm/°C maximum/unit	±100ppm/°C maximum/uni
Vibration		
	0.1 millisecond maximum	
	±2% maximum	
	±0.1% maximum	
Shock	0.1 millisecond maximum	
Total Posistance Chiff	±2% maximum	0.1 millisecond maximum
Voltage Patio Shift	±2% maximum	±2% Maximum
Load Life	1 000 hours 2 watte	1 000 hours 2 wette
Total Resistance Shift	±2% maximum	1,000 Hours, 2 watts
Rotational Life (No Load)	2 000 000 shaft revolutions	2 4 000 000 shaft revolutions
Total Resistance Shift	±5% maximum	+5% maximum
Moisture Resistance		
Total Resistance Shift	Condition B±2% maximum	±5% maximum
Mechanical Characteristics		0.0) ni 8300.0
Mechanical Angle	3600° +10° -0°	3600° ±10° -0°
Shaft Runout	0.002 in (0.05mm) TLB	0.002 in (0.05mm) TIP
Lateral Runout	0.005 in (0.13mm) T.I.R.	0.005 in (0.13mm) T.I.R.
Pilot Diameter Runout	0.002 in (0.05mm) T.I.R.	0.002 in (0.05mm) T.I.R.
Shaft End Play	0.005 in (0.13mm) TLR	0.005 in (0.13mm) T.I.P.
Shaft Radial Play	0.003 in (0.08mm) T.L.R.	0.003 in (0.08mm) T.I.P.
Stop Strength	96 oz -in (67.8 Ncm) min	96 oz -in (67.8 Ncm) min
Torque (Starting & Running)	0.6 oz -in (0.42 Ncm) may	0.6 oz-in (0.42 Ncm) may
Backlash		
Weight	Approximately 28G	Approximately 28G
Torminala	Cold plated solder lyes	pproximately 200

¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. ²Consult manufacturer for complete specification details for resistances below 500 ohms

Terminals Gold-plated solder lugs Gold-plated turret lugs
Ganging 2 cups maximum 2 cups maximum





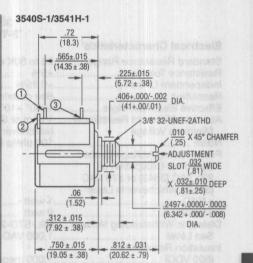
7/8" (22MM) DIAMETER / 10-TURN / WIREWOUND AND HYBRITRON® ELEMENT

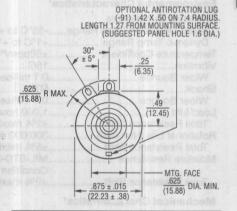
- Bushing mount
- Optional center tap and rear shaft extension
- Optional AR lug feature
- High torque availableOptional 0.1% linearity
- Non-standard features and specifications available
- Gangable with common or concentric shafts FOR ORDERING INFORMATION SEE PAGE 297.

Model 3540/3541

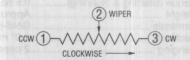
Bourns® Precision Potentiometers

	3540	3541
Electrical Characteristics¹	Wirewound Element	Hybritron® Element
Standard Resistance Range Resistance Tolerance		
Independent Linearity Resolution Effective Electrical Angle Absolute Minimum Resistance/	±0.25% See ordering information 3600° +10°, -0°	±0.25%Essentially infinite3600° +10°, -0°Minimum voltage
Minimum Voltage Noise	100 ohms ENR maximum	Output smoothness 0.1%
Power Rating (Voltage Limited By Power Dissipation or 447 VAC, Whichever Is Less)		
+70°C	0 watt	0 watt
Dielectric Withstanding Voltage Sea Level	1.000 VAC minimum	1.000 VAC minimum
Insulation Resistance (500 VDC)	1,000 megohms minimum	1,000 megohms minimum
Environmental Characteristics	1	
Operating Temperature Static Operation Temp Range Dynamic Temp Range Temperature Coefficient² Vibration Wiper Bounce Shock Wiper Bounce Load Life Total Resistance Shift Rotational Life (No Load) Total Resistance Shift Moisture Resistance Total Resistance Shift	+1°C to +125°C	+1°C to +125°C±100ppm/°C maximum/unit15G0.1 millisecond maximum50G0.1 millisecond maximum1,000 hours, 2 watts±5%5,000,000 shaft revolutions²±5% maximumMIL-STD-202, Method 103,
	±2% maximum	±5% maximum
Mechanical Characteristics¹ Mechanical Angle	3600° +10°0°	3600° +10°2°
Shaft Runout Lateral Runout Pilot Diameter Runout Shaft End Play Shaft Radial Play Stop Strength Torque (Starting & Running) Backlash Weight Terminals Ganging	0.003 in. (0.08mm) T.I.R	0.003 in. (0.08mm) T.I.R. 0.005 in. (0.13mm) T.I.R. 0.003 in. (0.08mm) T.I.R. 0.012 (0.30mm) T.I.R. 0.003 (0.08mm) T.I.R. 75 ozin. (53 Ncm) minimum 0.6 ozin. (0.35 Ncm) max. 1.0° maximum Approximately 22.5G Gold-plated solder lugs





TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{(.25)}$, $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$



¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. ²Consult manufacturer for complete specification details.



7/8" (22MM) DIAMETER / 3- AND 5-TURN WIREWOUND

- Bushing mount
- Optional AR pin feature
- Non-standard features and specifications available
- Gangable

FOR ORDERING INFORMATION SEE PAGE 297.

3545

Model 3543/3545

Bourns® Precision Potentiometers

	3-Turn	5-Turn	
Electrical Characteristics			
Standard Resistance Range Resistance Tolerance			
Independent Linearity			
Resolution	1080° +10°, -0°	1800° +10°, -0°	
Absolute Minimum Resistance/ Minimum Voltage		r) (whichever is gre	
Minimum Voltage Noise	100 ohms ENR max	imum100 ohms ENR r	
Power Rating (Voltage Limited By Power Dissipation or 224 VAC [3543] or 273 VAC [3545], Whichever Is Less)			
+70°C +125°C	1 watt	1.5 watt	
Dielectric Withstanding Voltage Sea Level	MIL-STD-202, Meth	od 301MIL-STD-202, M	
(500 VDC)	1,000 megohms mir	nimum1,000 megohms	minimum

3543

Environmental Characteristics¹

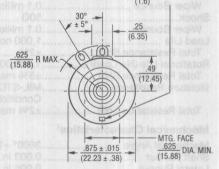
55°C to +125°C	55°C to +125°C
±50ppm/°C maximum/unit	±50ppm/°C maximum/unit
15G	15G
0.1 millisecond maximum	0.1 millisecond maximum
50G	50G
0.1 millisecond maximum	0.1 millisecond maximum
1,000 hours, 1 watt	1,000 hours, 1.5 watts
±2% maximum	±2% maximum
300,000 shaft revolutions	500,000 shaft revolutions
±5% maximum	±5% maximum
MIL-STD-202, Method 103,	MIL-STD-202, Method 103,
Condition B	Condition B
±2% maximum	±2% maximum

Mechanical Characteristics¹

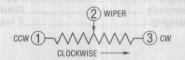
Mechanical Angle	1080° +10°, -0°1800° +10°, -0°
Shaft Runout	0.003 in. (0.08mm) T.I.R0.003 in. (0.08mm) T.I.R.
Lateral Runout	0.005 in. (0.13mm) T.I.R0.005 in. (0.13mm) T.I.R.
Pilot Diameter Runout	0.003 in. (0.08mm) T.I.R0.003 in. (0.08mm) T.I.R.
Shaft End Play	0.010 in. (0.25mm) T.I.R0.010 in. (0.25mm) T.I.R.
Shaft Radial Play	0.003 in. (0.08mm) T.I.R0.003 in. (0.08mm) T.I.R.
Stop Strength	75 ozin. (53 Ncm) min75 ozin. (53 Ncm) min.
Torque (Starting & Running)	0.5 ozin. (0.35 Ncm) max0.5 ozin. (0.35 Ncm) max.
Weight	Approximately 21GApproximately 21G
Terminals	Gold-plated solder lugsGold-plated solder lugs
Backlash	1.0° maximum1.0° maximum
Ganging	2 cups maximum2 cups maximum

NOTE: LOCKWASHER AND MOUNTING NUTS SUPPLIED. ADD .75 (19MM) FOR ADDITIONAL CUPS.

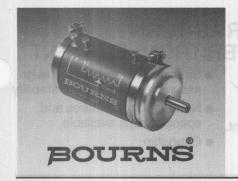
OPTIONAL ANTIROTATION LUG (-91) $\frac{.056 \times .02}{(1.42 \times .50)}$ ON $\frac{.29}{(7.4)}$ RADIUS LENGTH 1.27 FROM MOUNTING SURFACE. (SUGGESTED PANEL HOLE $\frac{.063}{(1.6)}$ DIA.)



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{.(.25)}$, $.XXX \pm \frac{.005}{.(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{.(MM)}$



^{&#}x27;At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
'Consult manufacturer for complete specification details.



7/8" (22MM) DIAMETER / 10-TURN WIREWOUND AND HYBRITRON® ELEMENT

■ Servo mount

- Gangable
- Excellent rotational life
- Excellent resolution
- Non-standard features and specifications available

FOR ORDERING INFORMATION SEE PAGES 297 AND 298.

Model 3550/3551

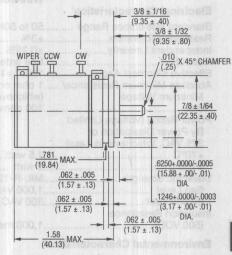
Bourns® Precision Potentiometers

	3550_	3551
Electrical Characteristics¹	Wirewound Element	Hybritron Element
Standard Resistance Range	±3% See ordering information 3600° +10°, -0° 1 ohm or 0.1% maximum	±10%±0.25%Essentially infinite3600° +10°, -2°Minimum voltage
Power Rating (Voltage Limited By Power Dissipation or 500 VAC [3550] or 325 VAC [3551], Whichever Is Less) +70°C	2.5 watts	thew 8.1
+125°C		
Dielectric Withstanding Voltage Sea Level	MIL-STD-202, Method 3011,000 VAC minimum	MIL-STD-202, Method 3011,000 VAC minimum
70,000 Feet		
(500 VDC)	1,000 megohms minimum .	1,000 megohms minimum
Environmental Characteristic	es¹	
Operating Temperature Static Operation Temp Range	65°C to +125°C	55°C to +105°C
Dynamic Temp Range	+1°C to +125°C	+1°C to +105°C
Temperature Coefficient ² Vibration Wiper Bounce	20G	20G
Total Resistance ShiftVoiltage Ratio Shift	±2% maximum	±2% maximum
Shock	100G	100G
Wiper Bounce		
Total Resistance ShiftVoiltage Ratio Shift	+0.2% maximum	+0.2% maximum
Load Life	1,000 hours, 2.5 watts	1,000 hours, 2 watts
Rotational Life (No Load)	1 000 000 shaft revolutions	10 000 000 shaft revolutions
Total Resistance Shift	±5% maximum	±5% maximum
Moisture Resistance Total Resistance Shift	MIL-STD-202, Method 103,	MIL-STD-202, Method 103,
Total Resistance Shift	±2% maximum	±5% maximum
Mechanical Characteristics ¹		
Mechanical Angle	3600° +10°, -0°	3600° +10°, -0°
Shaft RunoutLateral Runout		
Pilot Diameter Runout		
Shaft End Play	0.003 in. (0.08mm) T.I.R	0.003 in. (0.08mm) T.I.R.
Shaft Radial Play	0.002 in. (0.05mm) T.I.R	0.002 in. (0.05mm) T.I.R.
Stop Strength Torque (Starting)	0.4 oz -in. (0.30 Ncm) min	96 ozin. (67.8 Ncm) min.
Torque (Running)		
Backlash	1.0° maximum	1.0° maximum
Weight	Approximately 31G	Approximately 31G
Terminals	3 cups maximum	3 cups maximum

'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
2Consult manufacturer for complete specification details.

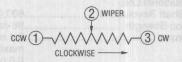
Specifications are subject to change without notice.

3550/3551





TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{.(.25)}$, $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$





7/8" (22MM) DIAMETER / 3-TURN WIREWOUND AND HYBRITRON® ELEMENT

- Servo mount
- Shaft supported front and rear by precision ball bearings
- High temperature, moisture resistant, thermosetting plastic housing

FOR ORDERING INFORMATION SEE PAGE 298.

- Special rotor and slider design assures excellent wiper stability
- Non-standard features and specifications available
- Gangable

Model 3560/3561

Bourns® Precision Potentiometers

	3560	3561
	Wirewound Element	Hybritron® Element
Electrical Characteristics ·		
Standard Resistance Range	50 to 50K ohms	500 to 20K ohms
Resistance Tolerance		
Independent Linearity		
Resolution		
Effective Electrical Angle		
Absolute Minimum Resistance/ Minimum Voltage	1 ohm or 0.1%,	0.1% maximum
Noise	100 ohms ENR maximum	Output smoothness 0.1%
Power Rating (Voltage Limited By Power Dissipation or		mumas n
325 VAC, Whichever Is Less)		
+70°C	1.5 watt	1.5 watt
+125°C		
Dielectric Strength	MIL-R-12934	MIL-R-12934
Sea Level		
80,000 Feet		
Insulation Resistance		
(500 VDC)	1,000 megohms minimum	1,000 megohms minimum
The second secon		

Environmental Characteristics¹

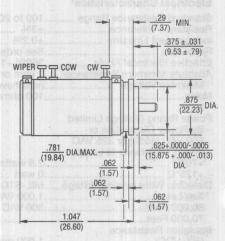
65°C to +125°C 20ppm/°C maximum	
: 12 Main (1997) - 12	
Humidity Cycling	Humidity Cycling
MIL-R-12934, 20G	
0.1 millisecond maximum	0.1 millisecond maximum
0.2% maximum	0.1% maximum
MIL-R-12934, 100G	MIL-R-39023, 100G
Same as vibration	Same as vibration
1,000 hours	1,000 hours
2% maximum	5% maximum
	20ppm/°C maximum

Mechanical Characteristics¹

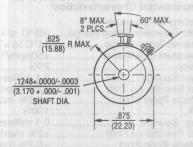
Mechanical Angle		1080° +10°, -0°
Shaft Runout	0.001 in. (0.03mm) T.I.R	0.001 in. (0.03mm) T.I.R.
Lateral Runout	0.003 in. (0.08mm) T.I.R	0.003 in. (0.08mm) T.I.R.
Pilot Diameter Runout	0.0015 in. (0.04mm) T.I.R.	0.0015 in. (0.04mm) T.I.R.
Shaft End Play		
Shaft Radial Play		
Rotational Life.	and the second s	
Shaft Revolutions	600,000	4.000.000
Stop Strength		96 ozin. (67.8 Ncm) min.
Torque		
	maximum starting/	maximum
	0.3 ozin. (0.25 Ncm)	SO O O REPORT STATE
	maximum running	
Moment of inertia	0.25G cm ²	0.25G cm ²
Ganging		the first of the f
9 9		
Weight		
Terminals	Gold-plated turret type	Gold-plated turret type
Markings	Manufacturer's name and	part number, resistance value
		erance, wiring diagram and
	date code.	oranoo, willing diagram and
	date code.	

¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. ²Consult manufacturer for complete specification details.

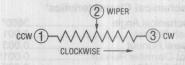
3560/3561



ADD 18.42 MAX. FOR EACH ADDITIONAL CUP.



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{(.25)}$, $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$





7/8" (22MM) DIAMETER / 10-TURN WIREWOUND

- Bushing mount
- Optional AR pin feature
- Plastic or metal shaft and bushings
- Wirewound
- Solder lugs or PC pins

FOR ORDERING INFORMATION SEE PAGE 298.

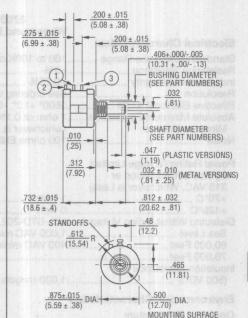
15-18 in.-lbs. (1.7 - 2 Ncm) (metal)1.0° maximumSolder lugs or PC pins

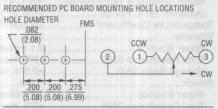
- Sealable
- Non-standard features and specifications available

Model 3590

Bourns® Precision Potentiometer

Electrical Characteristics ¹	ove 1 1078 , t
Standard Resistance Range	200 to 100K ohms
Resistance Tolerance	±5%
Independent Linearity	±0.25%
	See ordering information
Effective Electrical Angle	3600° +10°, -0°
	1 ohm or 0.1% maximum (whichever is greater)
Noise	100 ohms ENR maximum
Power Rating (Voltage Limited By Pow	er Less)
Dissipation or 450 VAC, Whichever is	Less)
+40°C	2 watts
	0 watt
	MIL-STD-202, Method 301
Insulation Posistance (500 VDC)	2,000 VAC minimum1,000 megohms minimum
	주시구의 이 내 그 경기 등에 가지 않는데 아니라 하는데
Environmental Characteristics ¹	
Operating Temperature	muminim OAV 000,7 mumini
Static Operation Temperature Range.	55°C to +125°C
Dynamic Operation Temperature Ran	ge55°C to +125°C
	±50ppm/°C maximum/unit
Vibration	15G
Wiper Bounce	0.1 millisecond maximum
	50G
	0.1 millisecond maximum
	1,000 hours, 2 watts
Patational Life (No. Load)	±2% maximum
Total Posistance Shift	
Moisture Resistance	MIL-STD-202, Method 103, Condition B
	±2% maximum
Mechanical Characteristics ¹	
Mechanical Angle	3600° +10°, -0°
	0.005 in. (0.13mm) T.I.R.
Torque (Starting & Rupping)	
rorque (Starting & Hurring)	1.5 ozin. (1.1 Ncm) maximum (unsealed)
Mounting Torque	5-7 inlbs. (0.55 - 0.80 Ncm) (plastic)





TOLERANCES: EXCEPT WHERE NOTED DECIMALS: .XX $\pm \frac{.02}{(.51)}$.XXX $\pm \frac{.005}{(.13)}$ FRACTIONS: ±1/64 DIMENSIONS: (MM)

SHAFT & BUSHING CONFIGURATIONS

(Bushing - DxL, Shaft - D)

(Busning - Dxt., Shart - U)
(-1) Plastic Bushing (3/8" x 5/16")
and Shaft (.2480 + .001, - .002)
(-2) Metal Bushing (3/8" x 5/16")
and Shaft (.2497 + .0000, - .0009)
(-3) Sealed, Plastic Bushing (3/8" x 5/16")
and Shaft (.2480 + .001, - .002)

and Shart (.2480 + .001, - .002)
(-4) Sealed, Metal Bushing (3/8" x 5/16")
and Shaft (.2497 + .0000, - .0009)
(-5) Metric, Plastic Bushing (9mm x 7.94mm)
and Shaft (6mm + 0, - .076mm)
(-6) Metric, Metal Bushing (9mm x 7.94mm)
and Shaft (6mm + 0, - .023mm)

(-7) Metric, Sealed, Plastic Bushing (9mm x 7.94mm) and Shaft (6mm + 0, - .076mm) (-8) Metric, Sealed, Metal Bushing (9mm x

7.94mm) and Shaft (6mm + 0, - .023mm)

NOTE: For Anti-Rotation pin add 91 after configuration dash number. Example: -2 becomes -291 to add AR pin. 'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. ²Consult manufacturer for complete specification details for resistance below 1K ohms. Specifications are subject to change without notice.

Weight................Approximately 19G



1/2" (12.7MM) DIAMETER / 10-TURN WIREWOUND AND HYBRITRON® ELEMENT

- Bushing mount
- Excellent resolution
- Non-standard features and specifications available
- Small diameter
- High rotational life

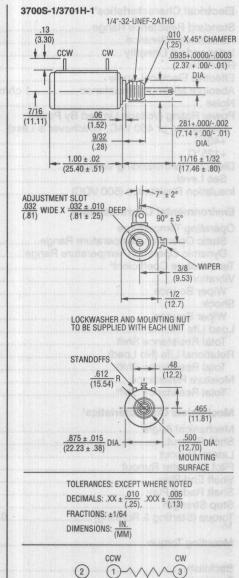
FOR ORDERING INFORMATION SEE PAGE 298.

Model 3700/3701

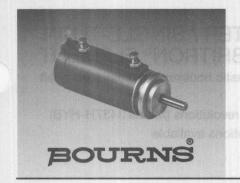
Bourns® Precision Potentiometers

	3700 Wirewound Element	3701 Hybritron® Element
Electrical Characteristics ¹	- Trackingal	Will State of the second state of the second
Standard Resistance Range		
Resistance Tolerance		
ndependent Linearity		
Resolution	See ordering information	Essentially infinite
Effective Electrical Angle	3600° +10°, -0°	3600° +10°, -2°
Absolute Minimum Resistance/	1 ohm or 0.1% maximum	Minimum voltage
Minimum Voltage Noise	(whichever is greater)	0.2% maximum
Noise	100 ohms ENR maximum	Output smoothness
Thursday The Section of the Party of the Par		0.1% max.
Power Rating (Voltage Limited		
By Power Dissipation or		
315 VAC, Whichever is Less) +70°C	reuminim C	AV 000 S
+70°C	1 watt	1 watt
+125°C	0 watt	0 watt
Dielectric Withstanding Voltage.	MIL-STD-202, Method 301	MIL-STD-202, Method 301
Sea Level	1,000 VAC minimum	1,000 VAC minimum
80,000 Feet	400 VAC minimum	9*82
70,000 Feet		300 VAC minimum
Insulation Resistance (500 VDC)	the trick area specifies	em Offerentia
(500 VDC)	1,000 megohms minimum	1,000 megohms minimum
Environmental Characteristic	CS ¹	
Operating Temperature		
Static Operation Temp Range.	-65°C to +125°C	-55°C to +105°C
Dynamic Temp Range	+1°C to +125°C	+1°C to +105°C
Temperature Coefficient ²	+50ppm/°C maximum/unit	+100ppm/°C maximum/unit
Vibration		
Wiper Bounce		
Total Resistance Shift	+2% maximum	+2% maximum
Voltage Ratio Shift	+0.5% maximum	0.5% maximum
Shock		
Wiper Bounce	0.1 millisecond maximum	0.1 millisecond maximum
Total Resistance Shift		
Voltage Ratio Shift	+0.5% maximum	+0.5% maximum
Load Life		
Total Resistance Shift		
Rotational Life (No Load)		
Total Resistance Shift	±5% maximum	±5% maximum
Moisture Resistance	MIL-STD-202. Method 103.	MIL-STD-202. Method 103.
Approximate the second second second second	Condition B	Condition B
Total Resistance Shift	±2% maximum	±5% maximum
Mechanical Characteristics¹		
Mechanical Angle	20000 - 500 - 00	000001-1
Chaft Durant	3600° +50°, -0°	3600° minimum
Shaft Runout	0.002 in. (0.05mm) 1.1.R	0.002 In. (0.05mm) T.I.R.
Shaft End Play	0.005 in. (0.13mm) 1.1.R	0.005 (0.13mm) 1.1.H.
Shaft Radial Play	0.003 in. (0.08mm) 1.1.R	0.003 in. (0.08mm) 1.1.R.
Stop Strength	20 oz-in. (14 Ncm) minimun	120 02-in. (14 Ncm) minimum
Torque (Starting & Running)	0.6 ozin. (U.45 Ncm) max.	ozin. (0.45 Ncm) max.
Backlash		
Weight	Approximately 28G	Approximately 28G
Terminals	Gold-plated solder lugs	Gold-plated turret lugs

'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
2 Consult factory for complete specification details.



- CW



1/2" (12.7MM) DIAMETER / 10-TURN WIREWOUND AND HYBRITRON® ELEMENT

- Servo mount
- Excellent resolution
- Non-standard features and specifications available
- Small diameter
- High rotational life

FOR ORDERING INFORMATION SEE PAGE 298 AND 299.

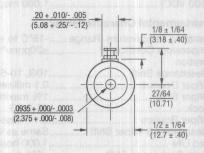
Model 3750/3751

Bourns® Precision Potentiometers

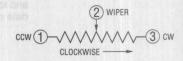
		YH-HY 3751
Electrical Characteristics¹	Wirewound Element	Hybritron® Element
Standard Resistance Range		
Resistance Tolerance		
Independent Linearity	±0.25%	±0.25%
Resolution	See ordering information	Essentially infinite
Effective Electrical Angle Absolute Minimum Resistance/	3600° +10°, -0°	3600° +10°, -4°
Absolute Minimum Resistance/	I Onm or 0.1% maximum	Willimum voltage
Minimum Voltage Noise	100 ohms END maximum	Output emoothness
Noise	100 OHHS ENA HAXIHUH	0.1% max.
Power Rating (Voltage Limited		Helm visionees rommont
By Power Dissipation or		
315 VAC Whichever is Less)		
315 VAC, Whichever is Less) +70°C +125°C	1 watt	1 watt
+125°C	0 watt	0 watt
Dielectric Withstanding Voltage	MIL-STD-202, Method 301	MIL-STD-202, Method 301
Sea Level	1.000 VAC minimum	1,000 VAC minimum
80,000 Feet	300 VAC minimum	
70,000 Feet		300 VAC minimum
Insulation Resistance		
(500 VDC)		
Environmental Characteristic	s ¹ murnixen	
Operating Temperature		
Static Operation Temp Range	65°C to +125°C	55°C to +105°C
Dynamic Temp Range	+1°C to +125°C	+1°C to +105°C
Temperature Coefficient ²	±50ppm/°C maximum/unit	±100ppm/°C maximum/unit
Vibration	20G	20G
Wiper Bounce Total Resistance Shift		
Voltage Ratio Shift	±2% maximum	0.204 maximum
Shock		
Wiper Bounce		
Total Resistance Shift		
Voltage Ratio Shift		
Load Life		
Total Resistance Shift		
Rotational Life (No Load)		
Total Resistance Shift		
Moisture Resistance	MIL-STD-202, Method 103,	MIL-STD-202, Method 103,
Total Resistance Shift	Condition B	Condition B
Total Resistance Shift	±2% maximum	±5% maximum
Mechanical Characteristics ¹		
Mechanical Angle		
Shaft Runout	0.003 in. (0.08mm) T.I.R	0.003 in. (0.08mm) T.I.R.
Lateral Runout	0.003 in. (0.08mm) T.I.R	0.003 in. (0.08mm) T.I.R.
Pilot Diameter Runout	0.002 in. (0.05mm) T.I.R	0.002 in. (0.05mm) T.I.R.
Shaft End Play		0.005 (0.13mm) I.I.R.
Shaft Radial PlayStop Strength		0.002 in. (0.05mm) 1.1.H.
Torque (Starting)	0.5 oz -in (0.25 Nom) minimun	0.5 oz in (0.35 Nom) may
Torque (Starting)	0.3 oz -in (0.25 Nom) max.	0.5 oz -in (0.35 Nom) max.
Backlash	1.0° maximum	1.0° maximum
Weight		
Terminals		
	pianea terroto imminin	piaroa iarroto

<sup>3750/3751

1.118 ± .015
(28.40 ± .38)
.062 + .010/- .005
(1.57 + .25/- .13)
.062 + .010/- .005
(1.57 + .25/- .03)
.375 + .010/- .005
(9.53 + .000 - .03)
.050 + .010/- .007
(12.70 + .30/- .20)
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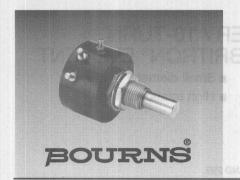


TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{(.25)}$ $.XXX \pm \frac{.005}{(.13)}$ DIMENSIONS: $\frac{IN.}{(MM)}$ FRACTIONS: $\pm 1/64$



¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. ²Consult factory for complete specification details.

Specifications are subject to change without notice.



1-1/16" (27MM) DIAMETER / SINGLE-TURN WIREWOUND AND HYBRITRON® ELEMENT

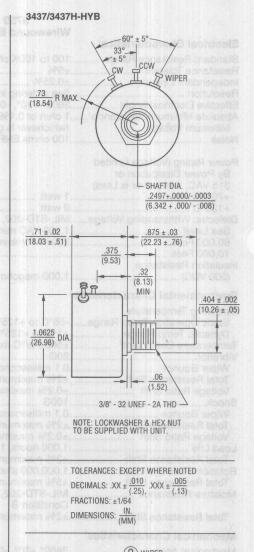
- Moisture resistant, thermosetting plastic housing; stainless steel shaft
- 1 watt power rating at 40°C
- Rotational life up to 4,000,000 shaft revolutions (Model 3437H-HYB)
- Non-standard features and specifications available

FOR ORDERING INFORMATION SEE PAGE 296.

Model 3437/3437H-HYB

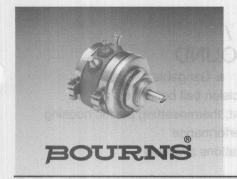
Bourns® Precision Potentiometers

	3437	3437H-HYB
Electrical Characteristics¹	Wirewound Element	Hybritron® Element
Standard Resistance Range Resistance Tolerance Independent Linearity Effective Electrical Angle Noise Output smoothness Power Rating	±5%	±10% ±0.5% 320° +5° 0.5% max.
+40°C	0 watt See ordering information MIL-R-12934 500 VAC minimum	0 watt Essentially infinite MIL-R-12934 500 VAC minimum
Environmental Characteristic	OS ¹	
Operating Temperature Range Temperature Coefficient ² Vibration Resistance Shift Wiper Bounce Wiper Shift Shock. Wiper Bounce Resistance & Wiper Shift Load Life Total Resistance Shift	±20ppm/°C maximum	±100ppm/°C maximum10G, 10-500 CPS0.1 millisecond maximum1% maximum15G0.1 millisecond maximumSame as Vibration1.000 hours
Mechanical Characteristics1 Mechanical Angle Rotational Life Torque (Starting & Running) Weight Terminals Markings	Continuous	4,000,000 shaft revolutions2.0 ozin. (1.4 Ncm) maxApproximately 30GGold-plated turrets art number, resistance value



ccw 1 — 3 cw

'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. 'Consult factory for complete specification details.



1-1/16" (27MM) DIAMETER / SINGLE-TURN WIREWOUND

■ Bushing mount

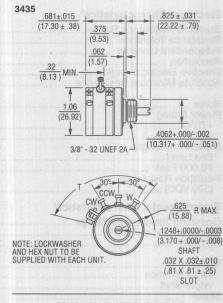
- Gangable
- Outstanding vibration and shock performance
- Shaft supported front and rear by precision sleeve bearings
- High temperature, moisture resistant, thermosetting plastic housing
- Non-standard features and specifications available

FOR ORDERING INFORMATION SEE PAGE 296.

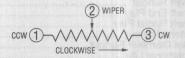
Model 3435

Bourns® Precision Potentiometer

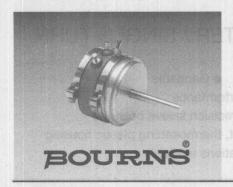
Electrical Characteristics ¹	
Resistance Tolerance	
Independent Linearity	±0.5%
Resolution	See ordering information
Effective Electrical Angle	350° ±2°
Absolute Minimum Resistan	ce1 ohm or 0.1% (whichever is greater)
Noise	100 ohms ENR maximum
Power Rating	
+70°C	1.5 watts
+125°C	0 watt
Dielectric Strength	1,000 VAC min.
Sea Level	1,000 VAC min.
70 000 F+	0001/40
Insulation Resistance	
(500 VDC)	1,000 megohms minimum
Environmental Characteris	tics'
Operating Temperature Rang	ge65°C to +125°C
Temperature Coefficient ²	±20ppm/°C max.
Humidity	MIL-R-12934 humidity cycling
Vibration	MII -R-12934 15G
Wiper Bounce	0.1 millisecond maximum
Wiper Shift	
	MIL-R-12934, 50G
Wiper Bounce	Same as Vibration
Load Life	
Resistance Shift	2 0% maximum
Marka in I Obasa in I di	81 Aug mm3010) or 100.0
Mechanical Characteristics	9.1.T (mm80.0) of 800.0
Mechanical Angle	
Shaft End Play	
Shaft Radial Play	
Rotational Life	2,000,000 shaft revolutions
Torque (Running)	
Torque (Additional Cups)	Add 75% each
	8 cups maximum
	Approx. 23G
Markings	Manufacturer's name and part number, resistance value
	and tolerance, linearity tolerance, wiring diagram, date code
a de la companya de	nd tolerance, infeatity tolerance, wiring diagram, date code



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $XX \pm \frac{.010}{(.25)}$, $XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$



^{&#}x27;At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. 2Consult factory for complete specification details.



2"" (51MM) DIAMETER / SINGLE-TURN WIREWOUND

■ Servo mount

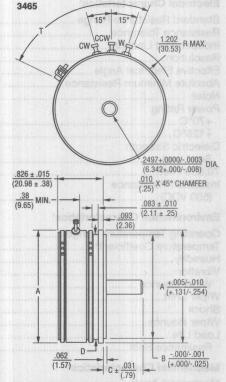
- Gangable
- Shaft support front and rear by precision ball bearings
- High temperature, moisture resistant, thermosetting plastic housing
- Outstanding vibration and shock performance
- Non-standard features and specifications available

FOR ORDERING INFORMATION SEE PAGE 298.

Model 3465

Bourns® Precision Potentiometers

Electrical Characteristics ¹	
Standard Resistance Range	
Power Rating +70°C	
70,000 Feet	
Environmental Characteristics¹	
Operating Temperature Range Temperature Coefficient ²	65°C to +125°C ±20ppm/°C max. MII -R-12934
Vibration	
Mechanical Characteristics¹	
Mechanical Angle	
Rotational Life Torque (Starting) Torque (Running) Moment of Inertia Ganging Weight Terminals Markings Manufacturer's na and toleran	



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{(.25)}$, $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$

DIMENSIONS - $\frac{\text{in.}}{\text{(mm)}}$

Model	ØA	ØB	C	ØD	T	Add for each additional cup
3465	2.00	1.8750	.625	1.875	90°+0-20°	0.500
3400	(50.80)	(47.63)	(15.81)	(47.62)		(12.7)



7/8" (22MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

- Servo mount
- Shaft supported by front and rear precision ball bearings
- Non-standard features and specifications available
- Gangable up to 10 cups

FOR ORDERING INFORMATION SEE PAGE 299.

Model 6534

Bourns® Precision Potentiometer

Electrical Characteristics¹

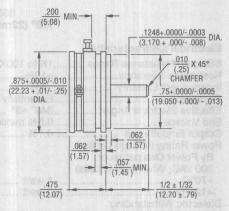
Standard Resistance RangeResistance Tolerance	1K to 100K ohms
Independent Linearity	
Effective Electrical Angle	
Minimum Voltage	
Power Rating (Voltage Limited By	Essentially infinite
Power Dissipation or 350 VAC, Whichever is Less) +70°C	1 watt
+125°C	0 watt
Output Smoothness	0.1%
Dielectric Withstanding Voltage	MIL-STD-202, Method 301
Sea Level	750 VAC minimum
70,000 Feet	250 VAC minimum
Insulation Resistance (500 VDC)	1,000 megohms minimum

Environmental Characteristics¹

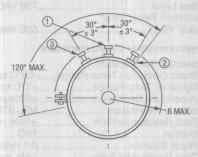
Operating Temperature Static Operation Temperature Range	65°C to +125°C
	+1°C to +125°C
Temperature Coefficient	±500ppm/°C maximum
Moisture Resistance	MIL-STD-202, Method 103, Condition B
Total Resistance Shift	±10% maximum
Vibration	15G
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±2% maximum
Shock	50G
	0.1 millisecond maximum
Rotational Life (No Load)	25,000,000 shaft revolutions
	±10% maximum

Mechanical Characteristics¹

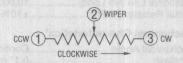
0.001 in. (0.025mm) T.I.R.
0.003 in. (0.08mm) T.I.R.
0.003 in. (0.08mm) T.I.R.
0.001 in. (0.025mm) T.I.R.
0.002 in. (0.05mm) T.I.R.
0.1° maximum
Continuous
ozin. (0.18 Ncm) maximum

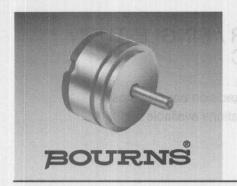


ADD 5.08MM FOR EACH ADDITIONAL CUP.



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.015}{(.38)}$, $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$





7/8" (22MM) DIAMETER / SINGLE-TURN / CONDUCTIVE PLASTIC

- Standard linearity: 1.0%
- Extended temperature range: -65°C to +125°C
- Extended life version (6538)

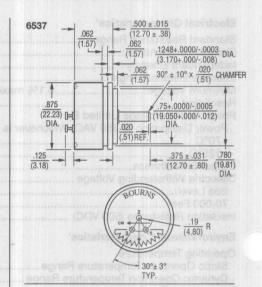
FOR ORDERING INFORMATION SEE PAGE 299.

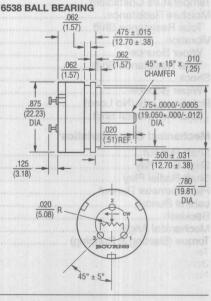
- Infinite resolution element Output smoothness: 0.1% standard
 - Molded-in rear terminals
 - Non-standard features and specifications available

Model 6537/6538

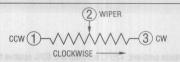
Bourns® Precision Potentiometers

	0502	0500
	6537 7/8" (22mm) Diameter	6538 7/8" (22mm) Diameter
		(Ball Bearing)
Electrical Characteristics		
Standard Resistance Range	1K to 100K ohms	1K to 100K ohms
Resistance Tolerance	±10%	±10%
Independent Linearity	±1%	±1%
Resolution Effective Electrical Angle		
End Voltage		
Output Smoothness	0.1%	0.1%
Power Rating (Voltage Limited		
By Power Dissipation or		
300 VAC, Whichever is Less)		
+70°C		
+125°C	0 watt	0 watt
Dielectric Withstanding Voltage	MIL STD 202 Mathad 201	MIL CTD 000 Mathed 201
Sea Level		
Insulation Resistance	750 VAC IIIIIIIIIIIIII	750 VAC ITIIITIIITIUITI
(500 VDC)	500 megohms minimum	1.000 megohms minimum
Environmental Characteristic		C. Will construct the construction and the con-
Operating Temperature		
Static Operation Temp Range	65°C to +125°C	65°C to +125°C
Dynamic Temp Range Temperature Coefficient	+1°C t0 +125°C	+1°C t0 +125°C
Moisture Resistance	MII -STD-202 Method 106	MII -STD-202 Method 106
Total Resistance Shift	+10% maximum	+10% maximum
Vibration		
Wiper Bounce		
Total Resistance Shift		
Voltage Ratio Shift		
ShockWiper Bounce	50G	50G
Total Resistance Shift		
Voltage Ratio Shift		
Load Life		
Total Resistance Shift		
Rotational Life (No Load)		
Total Resistance Shift		
Mechanical Characteristics		
Mechanical Angle	Continuous	Continuous
Backlash	0.1° maximum	0.1° maximum
Shaft Runout	0.005 in. (0.13mm) T.I.R	0.001 in. (0.025mm) T.I.R.
Shaft End Play	0.005 in. (0.13mm) T.I.R	0.005 in. (0.13mm) T.I.R.
Shaft Radial Play	0.005 (0.13mm) T.I.R	0.003 in. (0.08mm) T.I.R.
Pilot Diameter		
Runout	0.0025 in. (0.06mm) T.I.R	0.0025 in. (0.06mm) T.I.R.
Lateral Runout	0.003 In. (0.08mm) T.I.R	0.003 in. (0.08mm) T.I.R.
Torque (Starting & Running) Terminals	Molded-in rear	Moldad in room
Torriniais	violueu-iii real	Wolded-III fear

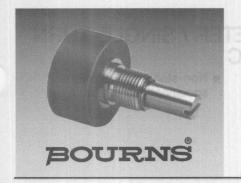




TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{(.25)}$ $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: ±1/64 DIMENSIONS: $\frac{IN}{(MM)}$



Specifications are subject to change without notice.



7/8" (22MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

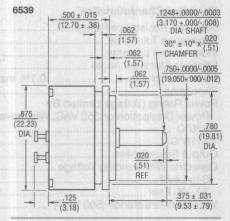
- Excellent rotational life
- High quality, rugged construction
- General purpose applications
- Essentially infinite resolution Non-standard features available
 - Cost and space saving

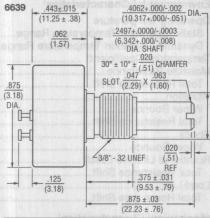
FOR ORDERING INFORMATION SEE PAGE 299.

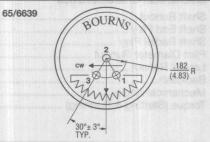
Model 6539/6639

Bourns® Precision Potentiometers

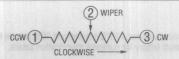
	6539 Servo Mount	6639 Bushing Mount
Electrical Characteristics		Alaman kamanan an
Standard Resistance Range Resistance Tolerance	1K to 100K ohms	1K to 100K ohms
Resistance Tolerance Standard Independent Linearity	±15%	±15%
Standard	±2.0%	±2.0%
Resolution	Essentially infinite	Essentially infinite
Effective Electrical Angle	340° +3°	340° +3°
End Voltage	0.5% maximum	0.5% maximum
Output Smoothness	0.1%	0.1%
Power Rating (Voltage Limited By Power Dissipation or		
300 VAC, Whichever is Less)		
300 VAC, Whichever is Less) +70°C	1.0 watt	1.0 watt
+125°C	0 watt	0 watt
Dielectric Withstanding Voltage Sea Level Insulation Resistance	750 VAC minimum	MIL-STD-202, Method 301 750 VAC minimum
(500 VDC)	500 megohms minimum	500 megohms minimum
Environmental Characteristic	s ¹ Drasr-or o	
Operating Temperature Static Operation Temp Range Dynamic Temp Range	65°C to +125°C	65°C to +125°C
VibrationWiper Bounce	15G	15G
ShockWiper Bounce	50G	50G 0.1 millisecond maximum
Rotational Life (No Load)	10,000,000 shaft revolutions	10,000,000 shaft revolutions
Mechanical Characteristics ¹		
Mechanical Angle	Continuous, Stops	Continuous, Stops
Backlash	(340° +8°, -0°) available	(340° +8° -0°) available
Backlash	0.1° maximum	0.1° maximum
Shaft Runout		
Shaft End Play		
Shaft Radial Play Pilot Diameter		et ni con o
Runout	0.0025 in. (0.06mm) T.I.R.	
Lateral Runout		
Torque (Starting & Running)		
Terminals		
Markings		
	part number, resistance	part number resistance
32FAX3043	value and tolerance.	value and tolerance.
	linearity tolerance,	linearity tolerance,
	wiring diagram and	
	date code.	date code.



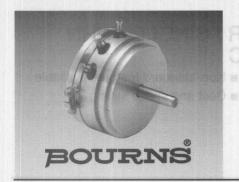




TOLERANCES: EXCEPT WHERE NOTED DECIMALS: .XX $\pm \frac{.015}{(.38)}$.XXX $\pm \frac{.005}{(.13)}$ FRACTIONS: ±1/64 DIMENSIONS: $\frac{IN.}{(MM)}$



^{&#}x27;At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.



1-1/16" (27MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

- Extended rotational life
- Ball bearings front and rear
- Servo mount
- Ganging up to 10 cups

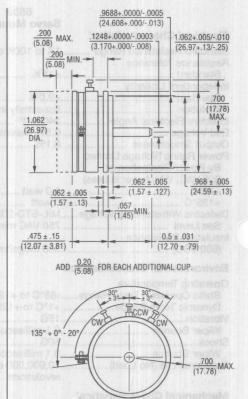
 Non-standard features and specifications available

FOR ORDERING INFORMATION SEE PAGE 299.

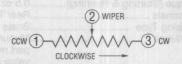
Model 6544

Bourns® Precision Potentiometer

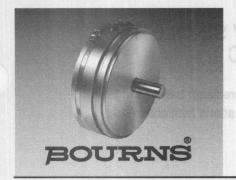
Electrical Characteristics	
Standard Resistance Range	±10%±0.50%350° ±2° 2% at 2K ohms, 0.4% at 1K ohms)Essentially infinite
Power Rating (Voltage Limited By Power Dissipation or 350 VAC, Whichever is Less) +70°C	
+125°C	
Output Smoothness	0.1%
Dielectric Withstanding Voltage Sea Level 70,000 Feet	MIL-STD-202, Method 3011,000 VAC minimum
Insulation Resistance (500 VDC)	1 000 megohms minimum
Environmental Characteristics ¹	muminati DAV CAX:
Operating Temperature Static Operation Temperature Range. Dynamic Operation Temperature Range Temperature Coefficient ² Moisture Resistance. Total Resistance Shift. Vibration. Wiper Bounce Total Resistance Shift Shock. Wiper Bounce Rotational Life (No Load) Total Resistance Shift Load Life Total Resistance Shift	
Mechanical Characteristics¹ Shaft Runout	
Shaft End Play Shaft Radial Play Pilot Diameter Runout Lateral Runout Backlash Mechanical Angle	
Torque (Starting & Running)	.0.25 ozin. (0.18 Ncm) maximum



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $XX \pm \frac{.010}{(.25)}$. $XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$



¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. ²Consult factory for complete specification details.



2" (51MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

- Servo mount style
- Shaft supported by front and rear precision ball bearings
- Non-standard features and specifications available
- Gangable up to 10 cups

FOR ORDERING INFORMATION SEE PAGE 299.

Model 6574

Bourns® Precision Potentiometer

Electrical Characteristics¹

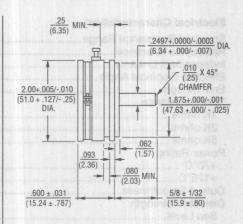
Standard Resistance Range	1K to 100K ohms
Resistance Tolerance	
Independent Linearity	±0.25%
Effective Electrical Angle	350° ±2°
Minimum Voltage	
Power Rating (Voltage Limited By	dispersion of the second of th
Power Dissipation or 350 VAC, Whichever is Less)	
+70°C	2 watts
+125°C	
Output Smoothness	0.1%
Dielectric Withstanding Voltage	MIL-STD-202, Method 301
Sea Level	
70,000 Feet	350 VAC minimum
Insulation Resistance (500 VDC)	

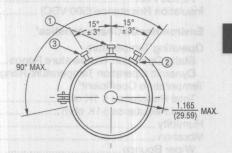
Environmental Characteristics¹

Operating Temperature Static Operation Temperature Range	65°C to +125°C
	+1°C to +125°C
Temperature Coefficient ²	
Moisture Resistance	
	±10% maximum
Vibration	15G
Wiper Bounce	0.1 millisecond maximum
	±2% maximum
Shock	60G
	0.1 millisecond maximum
Rotational Life (No Load)	25,000,000 shaft revolutions
Total Resistance Shift	±10% maximum
Load Life	1,000 hours, 1.5 watts
Total Resistance Shift	±10% maximum

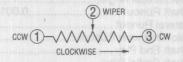
Mechanical Characteristics

Shaft Runout	
Shaft Radial Play	0.003 in. (0.08mm) T.I.R.
Lateral Runout	0.003 in. (0.08mm) T.I.R.
Backlash	0.1° maximum
Mechanical Angle	

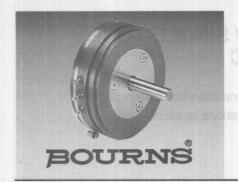




TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $XX \pm \frac{.015}{(.38)}$, $XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$



¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.



2" (51MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

- Servo mount style
- Shaft supported by front and rear precision ball bearings
- Non-standard features and specifications available
- Gangable up to 10 cups

FOR ORDERING INFORMATION SEE PAGE 299.

Model 6575

Bourns® Precision Potentiometer

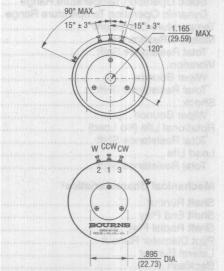
Electrical Characteristics	
Standard Resistance Range	1K to 100K ohms
Resistance Tolerance	
Independent Linearity	±0.1%
Effective Electrical Angle	350° ±2°
End Voltage	MIL-R-39023
	Essentially initrib
1K ohms	0.4%
2K ohms	
5K ohms	
Power Rating	tsw O
+70°C	2 watts
+125°C	0 watt
Output Smoothness	
Sea Level	1,000 VAC minimum
70,000 Feet	
Insulation Resistance (500 VDC)	
Environmental Characteristics¹	

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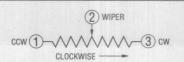
Mechanical Characteristics¹

Mechanical Angle	Continuous
Shaft Runout	0.001 in. or 0.003 in. (0.025mm or 0.05mm) shaft length
Lateral Runout	
Shaft End Play	
Shaft Radial Play	
Rotational Life, Shaft Revolution	onsMIL-R-39023
	100 X 10 to power 6 revolutions (100 million)
	resistance change 10% max, symbol 4
Torque (Starting & Running)	0.25 oz-in. maximum

^{1.875+.0000/.0001} (47.63+.00/-.03) DIA. 2.00+.005/-.009 (50.80+.13/-.25) DIA. .2497+.0000/-.0003 (6.34+.00/-.005) DIA. 2.00+.005/-.010 MAX. (50.80) (47.50)DIA. DIA. (1.57 ± .13) (2.36 ± .13) 5/8 ± 1/32



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: .XX $\pm \frac{.015}{(.381)}$, .XXX $\pm \frac{.005}{(.127)}$ FRACTIONS: ±1/64 DIMENSIONS: $\frac{IN}{(MM)}$



² Consult factory for complete specification details.

¹ At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.



7/8" (22MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

- Bushing mount
- Excellent resolution
- High rotational life (ball bearing shaft support available 6638)
- Non-standard features and specifications available

FOR ORDERING INFORMATION SEE PAGE 299.

6638

Model 6637/6638

Bourns® Precision Potentiometers

	7/8" (22mm) Diameter	7/8" (22mm) Diameter (Ball Bearing)
Electrical Characteristics¹		tario i pero Appendia antico e e e e e e e e e e e e e e e e e e e
Standard Resistance Range Resistance Tolerance	±10%	±10% ±1% 340° +3° 0.5% maximum 0.1% maximum Essentially infinite
300 VAC, Whichever is Less) +70°C	1 watt 0 watt MIL-STD-202, Method 301	0 watt MIL-STD-202, Method 301

(500 VDC)1,000 megohms minimum1,000 megohms minimum

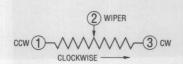
6637

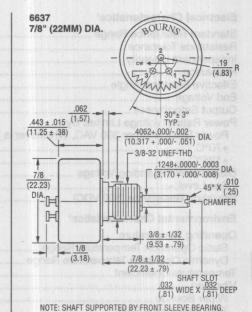
Environmental Characteristics

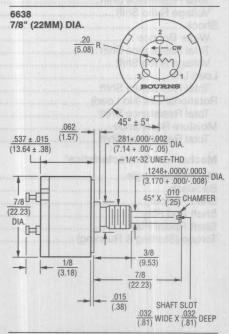
Environmental Characteris	tics.	
	e65°C to +125°C +1°C to +125°C	
Temperature Coefficient	±500ppm/°C maximum	±500ppm/°C maximum
Moisture Resistance	MIL-STD-202, Method 106	MIL-STD-202, Method 106
Total Resistance Shift	±10% maximum	±10% maximum
Vibration	15G	15G
Wiper Bounce	0.1 millisecond maximum	0.1 millisecond maximum
Total Resistance Shift	±5% maximum	±5% maximum
Voltage Ratio Shift	±0.5% maximum	±0.5% maximum
Shock	50G	50G
Wiper Bounce	0.1 millisecond maximum	0.1 millisecond maximum
Total Resistance Shift	±5% maximum	±5% maximum
Voltage Ratio Shift	±0.5% maximum	±0.5% maximum
	10,000,000 shaft	
Matter SMO	revolutions	revolutions
Total Resistance Shift	±10% maximum	±10% maximum
Load Life	1,000 hours, 1 watt	1,000 hours, 1 watt
	±10% maximum	

Mechanical Characteristics¹

Mechanical Angle	Continuous	Continuous
Backlash	0.1° maximum	0.1° maximum
Shaft Runout	0.001 in. (0.025mm) T.I.R	0.001 in. (0.025mm) T.I.R.
Shaft End Play		
Shaft Radial Play		
Torque (Starting & Running)	0.5 ozin. (0.40 Ncm) max.	0.25 ozin. (0.18 Ncm) max.







TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.015}{(.381)}$, $.XXX \pm \frac{.005}{(.127)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$

¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.



1-5/16" (33MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

- Bushing mount
- Shaft supported by front sleeve bearing
- Non-standard features and specifications available

FOR ORDERING INFORMATION SEE PAGE 300.

Model 6657

Bourns® Precision Potentiometer

Flectrical Characteristics

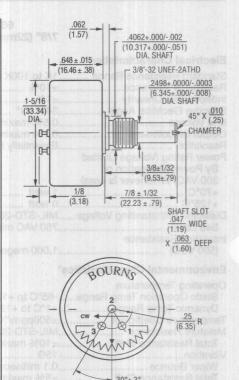
Electrical Characteristics	
Standard Resistance Range	1K to 100K ohms
Resistance Tolerance	±10%
Independent Linearity	
Resolution	
Effective Electrical Angle	
End Voltage	0.5% maximum
Output Smoothness	0.1%
Power Rating (Voltage Limited By	
Power Dissipation or 300 VAC, Whichever is Less)	
+70°C	1.5 watts
+125°C	
Dielectric Withstanding Voltage	
Sea Level	
Insulation Resistance (500 VDC)	

Environmental Characteristics¹

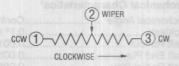
Operating temperature	
Static Operation Temperature Range	65°C to +125°C
Dynamic Operation Temperature Range	
Temperature Coefficient	
Vibration	
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	
Voltage Ratio Shift	±0.5% maximum
Shock	50G
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±5% maximum
Voltage Ratio Shift	±0.5% maximum
Load Life	1,000 hours, 1.5 watts
Total Resistance Shift	
Rotational Life (No Load)	10,000,000 shaft revolutions
Total Resistance Shift	±10% maximum
Moisture Resistance	MIL-STD-202, Method 106
Total Resistance Shift	±15% maximum

Mechanical Characteristics¹

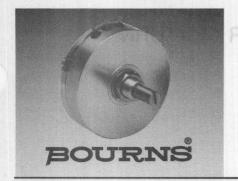
Mechanical Angle	
Backlash	0.1° maximum
Shaft Runout	
Shaft End Play	
Shaft Radial Play	
Torque (Starting & Running)	



$$\label{eq:total_control_total} \begin{split} & \text{TOLERANCES: EXCEPT WHERE NOTED} \\ & \text{DECIMALS: .XXX} \pm \frac{.010}{(.25)}, \text{.XXX} \pm \frac{.005}{(.13)} \\ & \text{FRACTIONS: } \pm 1/64 \\ & \text{DIMENSIONS: } \frac{\text{IN.}}{(\text{MM})} \end{split}$$



¹ At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.



2" (51MM) DIAMETER / SINGLE-TURN CONDUCTIVE PLASTIC

- Excellent resolution
- High rotational life
- Bushing mount
- Gangable up to 10 cups
- Ball bearings
- Non-standard features and specifications available

...±10% maximum

FOR ORDERING INFORMATION SEE PAGE 300.

Model 6674

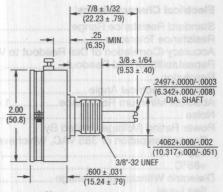
Bourns® Precision Potentiometer

Electrical Characteristics¹	
Standard Resistance Range	1K to 100K ohms
	±10%
Independent Linearity	±0.25%
Effective Electrical Angle	350° ±2°
Resolution	Essentially infinite
Power Rating (Voltage Limited By	isrimon °0088
Power Dissipation or 350 VAC, Whichever	r is Less) no at to vertainly municipant 32 r.0 no n
	2 watts
+125°C	0 watt
Output Smoothness	0.1%
Dielectric Strength (VRMS)	1,000 VAC minimum
Sea Level	1,000 VAC minimum
	350 VAC minimum
	1,000 megohms minimum
Environmental Characteristics ¹	
Test Procedures Per	MIL-STD-202, Method 106
	65°C to +125°C
Resistance Temperature Coefficient	±5% TRS
Moisture Resistance Characteristics	Resistance change ±10% maximum
	15G
Shock	60G
Rotational Life	25 000 000 shaft revolutions

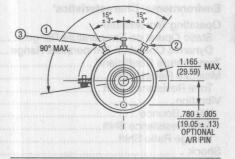
Mashaniaal	Chavastavistical
iviecnanicai	Characteristics ¹

Medianical Onalacteristics	
Shaft Runout	0.001 in. (0.025mm) T.I.R.
Shaft End Play	
	0.1° maximum
Mechanical Angle	Continuous
Torque (Starting & Running)	

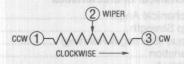
Total Resistance Shift.....



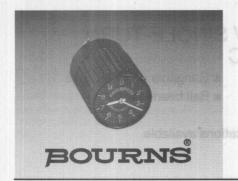
ADD $\frac{.20}{(5.08)}$ FOR EACH ADDITIONAL CUP.



TOLERANCES: EXCEPT WHERE NOTED DECIMALS: .XX $\pm \frac{.010}{(.25)}$, .XXX $\pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$



¹ At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.



3/4" (19MM) DIAMETER / 10-TURN WIREWOUND

- Bushing mount | Deep Melleox | Deep Note | Deep Not
- Cost saving; pre-phased
- Highly readable clockface readout
- Easy mounting

FOR ORDERING INFORMATION SEE PAGE 300.

Model 3600

Knobpot® Precision Potentiometer

Accuracy (Correlation of Dial Readout to Voltage	Ratio Output)±0.5% voltage ratio
Repeatability of Dial Readout	±0.1% voltage ratio
Resolution	See ordering information
Effective Electrical Angle	3600° nominal
Absolute Minimum Resistance1 ohm or	
Noise	
Power Rating (Voltage Limited By	
Power Dissipation or 385 VAC, Whichever is Les	ss)
+25°C	
+85°C	0 watt
Dielectric Withstanding Voltage	MIL-STD-202, Method 301
	1,000 VAC minimum
70,000 Feet	400 VAC minimum
Insulation Resistance (500 VDC)	

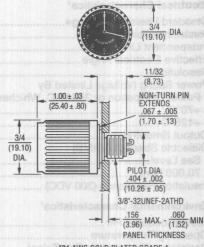
Resistance Tolerance.....±5%

Environmental Characteristics¹

	65°C to +85°C
Temperature Coefficient ²	±50ppm/°C maximum/unit
	MIL-STD-202, Method 103, Condition B±2% maximum
Vibration	
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±2% maximum
Voltage Ratio Shift	±0.2% maximum
Shock	50G
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±2% maximum
Voltage Ratio Shift	±0.2% maximum
Load Life	1.000 hours, 1.5 watts
Total Resistance Shift	±2% maximum
Rotational Life (No Load) ²	200,000 shaft revolutions±2% maximum

Mechanical Characteristics¹

Medianical Onal acteristics	
Mechanical Angle	3600° +20°, -0°
Stop Strength	
Torque (Starting & Running)	4.0 ozin. (2.8 Ncm) maximum
Variation	1.0 ozin. (0.71 Ncm) maximum
Backlash	1.0° maximum
Weight	Approximately 17G
Terminals	Gold-plated J-Hooks
MarkingsManufacturer's name and	part number, resistance value and date code

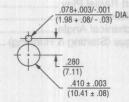


#21 AWG GOLD PLATED GRADE A
NICKEL SOLDER LUGS (.724 DIA.)
LOCATED ON .05 RADIUS

1/8±1/32
(3.18 ± .79)

NON-TURN PIN
EXTENDS
.067 ± .005
(1.70 ± .13)

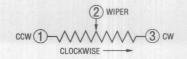
.078+.003/-.001



PANEL HOLE PATTERN

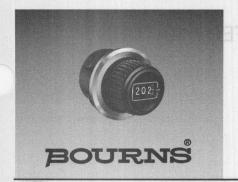
LOCKWASHER AND MOUNTING NUT TO BE SUPPLIED WITH EACH UNIT

TOLERANCES: EXCEPT WHERE NOTED DECIMALS: $.XX \pm \frac{.010}{(.25)}$, $.XXX \pm \frac{.005}{(.13)}$ FRACTIONS: $\pm 1/64$ DIMENSIONS: $\frac{IN}{(MM)}$



^{&#}x27;At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.

2Consult manufacturer for complete specification details for resistances below 100 ohms.



7/8" (22MM) DIAMETER / 10-TURN / DIGITAL / WIREWOUND

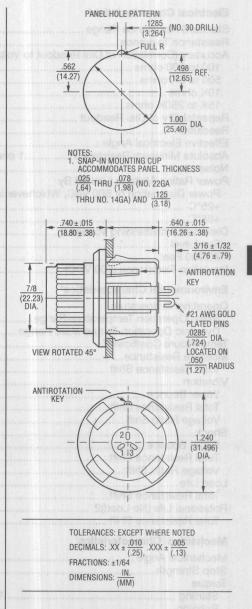
- Snap-in mounting
- Space saving extends only 5/8" behind most panels
- Easy one-hole, snap-in mounting
- Digital dial provides excellent readability

FOR ORDERING INFORMATION SEE PAGE 300.

Model 3610

Knobpot® Precision Potentiometer

Electrical Characteristics¹	
Standard Resistance Range	100 to 100K ohms
Resistance Tolerance	±5%
Accuracy (Correlation of Dial Readout to Vol	Itage Ratio Output)±0.5% voltage ratio
Repeatability of Dial Readout	±0.1% voltage ratio
Resolution	See ordering information
Effective Electrical Angle	3600° nominal
Absolute Minimum Resistance1 of	nm or 0.1% maximum (whichever is greater)
Noise	100 ohms ENR maximum
Power Rating (Voltage Limited By	See ordering Information
Power Dissipation or 385 VAC, Whichever	is Less)
	1.5 watts
	0 watt
Dielectric Withstanding Voltage	
	1,000 VAC minimum 400 VAC minimum
Insulation Resistance (500 VDC)	1 000 megohns minimum
	A THE RESERVE AND ADDRESS OF THE PARTY OF TH
Environmental Characteristics ¹	
Operating remperature	
	25°C to +85°C
	+1°C to +85°C
Temperature Coefficient ²	±50ppm/°C maximum/wire
Total Posistance Shift	±2% maximum
Vibration	
	0.1 millisecond maximum
	±2% maximum
	±0.2% maximum
Shock	50G
	0.1 millisecond maximum
Total Resistance Shift	±2% maximum
	±0.2% maximum
Load Life	1,000 hours, 1.5 watts
	±2% maximum
Rotational Life (No Load)	±2% maximum
	±2% maximum
Mechanical Characteristics¹	
Mechanical Angle	3600° +20°, -0°
Stop Strength	20 ozin. (14 Ncm) minimum
Torque (Starting & Running)	
Backlash	1.0 ozin. (u./ i Ncm) maximum
Weight	
Troigitt	Approximately 20G

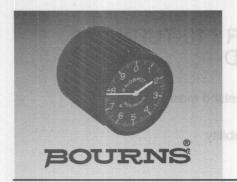


(2) WIPER

CLOCKWISE

¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
²Consult manufacturer for complete specification details for resistances below 500 ohms and above 100K ohms.

Terminals...........Gold-plated J-Hooks MarkingsManufacturer's name and part number, resistance value and date code



1-1/4" (32MM) DIAMETER / 10-TURN / WIREWOUND

- Bushing mount
- Integral clockface readout
- Cost saving; pre-phased
- Highly readable clockface readout

FOR ORDERING INFORMATION SEE PAGE 300.

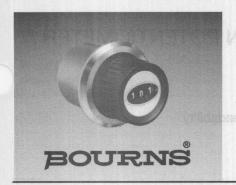
Model 3640

Knobpot® Precision Potentiometer

Electrical Characteristics¹	
Standard Resistance Range	100 to 250K ohms
Resistance Tolerance	
Accuracy (Correlation of Dial Readout to Voltage	
100 to 200 ohms	±0.20% voltage ratio
500 to 5K ohms	
10K ohms	
15K to 250K ohms	
Repeatability of Dial Readout	
Resolution	See ordering information
Effective Electrical Angle	
Absolute Minimum Resistance1 ohm or	0.1% maximum (whichever is greater)
Noise	100 ohms FNR maximum
Power Rating (Voltage Limited By Power Dissipation or 500 VAC, Whichever is Le	Chestal COC.OT2. HA
Power Dissipation or 500 VAC. Whichever is Le	(22
+25°C	2.5 watts
+85°C	
Dielectric Withstanding Voltage	
Sea Level	
70,000 Feet	
Insulation Resistance (500 VDC)	1 000 megohns minimum
	dle of O'Te
Environmental Characteristics¹ Operating Temperature	
Operating Temperature	
Static Operation Temperature Range	65°C to +85°C
Dynamic Operation Temperature Range	+1°C to +85°C
Temperature Coefficient ²	±50ppm/°C maximum/wire
Moisture Resistance	IL-STD-202, Method 103, Condition B
Total Resistance Shift	±2% maximum
Vibration	
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±2% maximum
Voltage Ratio Shift	±0.2% maximum
Shock	50G
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±2% maximum
Voltage Ratio Shift	±0.2% maximum
Load Life	
Total Resistance Shift	+2% maximum
Rotational Life (No Load)2	100,000 shaft revolutions
Total Resistance Shift	
THE THE PROPERTY OF THE PROPER	
Mechanical Angle	
Mechanical Angle	3600° +10°, -0°
Stop Strength	48 ozin. (33.80 Ncm) minimum
Torque	cort-L batalq-Uo9
Starting1.0 -	10.0 ozin. (0.70 - 7.1) Ncm maximum
Running	10.0 ozin. (7.1 Ncm) maximum
Variation	
Weight	Approximately 49G
Terminals	Gold-plated J-Hooks
MarkingsManufacturer's name and part n	umber, resistance value and date code

'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. 2Consult manufacturer for complete specification details.

PANEL THICKNESS .046 (1.17) MIN. - .156 (3.96) MAX.-NON-TURN PIN EXTENDS $\frac{.069 \pm .015}{(1.75 \pm .38)}$ - 3/8"-32 UNEF-2A THD (31.75) DIA. .406+.000/-.004 (10.31 ± .00/ - .10) PANEL HOLE PATTERN NOTE: LOCKWASHER AND HEX NUT SUPPLIED WITH EACH UNIT. TOLERANCES: EXCEPT WHERE NOTED DECIMALS: .XX $\pm \frac{.010}{(.25)}$.XXX $\pm \frac{.005}{(.13)}$ FRACTIONS: ±1/64 DIMENSIONS: $\frac{IN.}{(MM)}$



1-1/4" (32MM) DIAMETER / 10-TURN / DIGITAL / WIREWOUND

- Easy single-hole mounting with recessed cup provided
- Digital dial provides excellent readability
- Cost saving; pre-phased

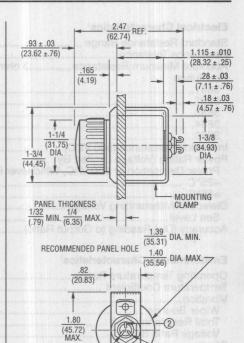
FOR ORDERING INFORMATION SEE PAGE 300.

Model 3650

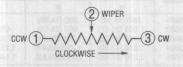
Knobpot® Precision Potentiometer

Electrical Characteristics¹	
Standard Resistance Range	100 to 100K ohms
Resistance Tolerance	±3%
Accuracy (Correlation of Dial Readout	to Voltage Ratio Output)
100 to 200 ohms	±0.20% voltage ratio
500 to 5K ohms	±0.15% voltage ratio
	±0.12% voltage ratio
	±0.10% voltage ratio
	±0.05% voltage ratio
Resolution	See ordering information
Effective Electrical Angle	3600° nominal
Absolute Minimum Resistance	1 ohm or 0.1% maximum (whichever is greater)
Noise	
Power Rating (Voltage Limited By	
Power Dissipation or 500 VAC, Which	never is Less)2.5 watts
+25°C	2.5 watts
+85°C	0 watt
Dielectric Withstanding Voltage	MIL-STD-202, Method 301
Sea Level	1,000 VAC minimum
	250 VAC minimum
Insulation Resistance (500 VDC)	1,000 megohms minimum
Environmental Characteristics	Puritism bridgestim 1.0
Operating Temperature	25°C to +85°C
Static Operation Temperature Pange	-25°C to 185°C
Dynamic Operation Temperature Ran	ge+1°C to +85°C
Temperature Coefficient ²	±50ppm/°C maximum/wire
Moisture Resistance	MIL-STD-202, Method 103, Condition B
Total Resistance Shift	±2% maximum
	10G
	0.1 millisecond maximum
Total Resistance Shift	±2% maximum
	±0.2% maximum
	50G
Total Resistance Shift	±2% maximum
Voltage Ratio Shift	±0.2% maximum
Load Life	1,000 hours, 2.5 watts
	±2% maximum
Rotational Life (No Load)	100,000 shaft revolutions
Total Resistance Shift	±4% maximum
Mechanical Characteristics ¹	
Machanical Angle	2600° 110° 0°
Stop Strongth	
Torque	46 02III. (33.6 NCIII) MINIMUM
Starting	1.0 - 15.0 ozin. (0.7 - 10.6 Ncm) maximum
Dunning	1.0 - 15.0 62in. (0.7 - 10.6 Ncm) maximum
I IOI II III IO	
	1.0° maximum
	Approximately 112G
Markings Manufacturar's name	and part number, resistance value and date code
Markings	and part number, resistance value and date code
'At room ambient: +25°C nominal and 50% relative hi	umidity nominal, except as noted.

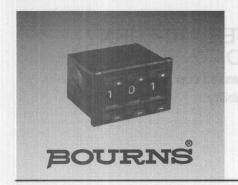
¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. ²Consult manufacturer for complete specification details.



NOTE: LOCKWASHER HEX NUT AND 2 MOUNTING CLAMPS SUPPLIED WITH EACH UNIT.



Specifications are subject to change without notice.



DIGITAL PUSHBUTTON POTENTIOMETER / CERMET

- Repeatable settings
- Resolution to 0.001%
- Digital display provides excellent readability
- Snap-in panel mount

FOR ORDERING INFORMATION SEE PAGE 300.

Model 3680

Knobpot® Precision Potentiometer

Electrical Characteristics¹

Standard Resistance Range	00/
Absolute Minimum Resistance3 ohms or 0.2% n Resolution	naximum (whichever is greater)
3681	10%
3682	UV ST
3683	
3684	
3685	0.001%
Insulation Resistance (500 VDC)	
Power Rating (Voltage Limited By	30863801
Power Dissipation or 500 VAC, Whichever is Less)	
+25°C	2 watts
+85°C	
Dielectric Withstanding Voltage	
Sea Level	1,000 VAC minimum
Accuracy (Dial Reading to Output Ratio)	±0.5% full scale
	±2.0% (3681 only)

Environmental Characteristics¹

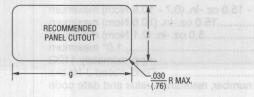
Operating Temperature Range	-25°C to +85°C
Temperature Coefficient	±100ppm/°C maximum
Vibration	
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±1% maximum
Voltage Ratio Shift	±0.2% maximum
Shock	50G
Wiper Bounce	0.1 millisecond maximum
Total Resistance Shift	±1% maximum
Voltage Ratio Shift	±0.2% maximum
Load Life	1,000 hours, 2 watts
Total Resistance Shift	±2% maximum

Mechanical Characteristics¹

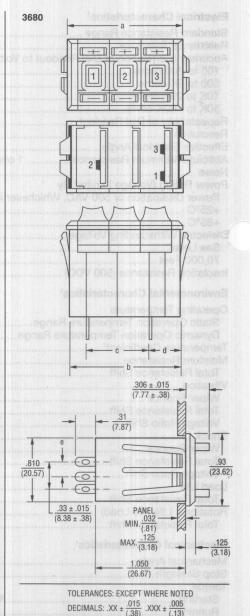
Expected Life	75,000 button operations each decade
Total Resistance Shift	±2% maximum
Terminals	0.11 in. (2.79mm) wide x .016 in. (.41mm) thick,
	tinned solder lugs for 3 #20 AWG wires

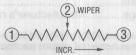
Model	Dimensions Dimensions					Weight (Approx.)	
Model	a	b	С	d	e ±.015 (±.381)	oz.	gms.
3681	.650 (16.51)	.590 (14.99)		.39 (9.91)	.165 (4.19)	.336	9.5
3682	1.050 (26.67)	.990 (25.15)	.420 (10.67)	.47 (11.94)	.330 (8.38)	.576	16.5
3683	1.460 (37.08)	1.390 (35.31)	.730 (18.54)	.47 (11.94)	.165 (4.19)	.824	23.5
3684 3685	1.870 (47.50) 2.270 (57.66)	1.790 (45.47) 2.190 (55.63)	1.210 (30.73) 1.540 (39.12)	.47 (11.94) .47 (11.94)	.330 (8.38) .165 (4.19)	1.072	30.5 37.5

Madel	Dimensions			
Model	f ±.010 (±.254)	g ±.010 (±.254) .620 (15.75)		
3681	.830 (21.08)			
3682	.830 (21.08)	1.020 (25.91)		
3683	.830 (21.08)	1.420 (36.07)		
3684	.830 (21.08)	1.820 (46.23)		
3685	.830 (21.08)	2.220 (56.39)		



'At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted. NOTE: Terminals 1 & 3 are reversed from illustration for models 3682 and 3684.





FRACTIONS: ±1/64
DIMENSIONS: IN. (MM)

Specifications are subject to change without notice.



PROTECTOR FOR PUSHBUTTON POTENTIOMETER

■ For use with Model 3680 digital pushbutton precision potentiometer

Model H-385

Panel Seal Assembly

Physical Characteristics¹

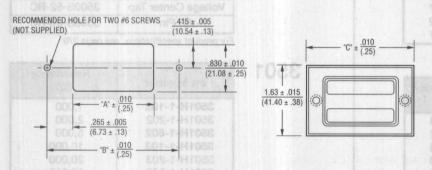
	Clear silicone rubber Rigid black plastic
Expected Life	
	Approximately 7.09G
H-385-2	
H-385-3 H-385-4	Approximately 9.92G
11 005 5	Approximately 11.34G Approximately 12.76G

APPLICATION DATA

- · Protects front of the pot from unwanted entry of rain, dust, grease or oils
- Transparent for easy viewing of numerals
- Tear resistant for long life
- Matte finish black plastic frame to complement most front panels

Bourns® Model H-385 Panel Seal Assembly minimizes accidental entry of liquids or foreign matter through the front of the Model 3680 Family Potentiometer.

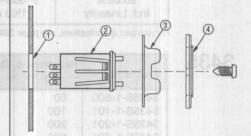
PANEL CUT-OUT/HOLE DIMENSIONS



For Use With	Part Number	Frame Dimensions "C"	Panel Cutout/ Hole Dimensions "A" "B"	
3681	H-385-1	1.592 (40.44)	.620 (15.75)	1.150 (29.21)
3682	H-385-2	1.992 (50.60)	1.020 (25.91)	1.550 (39.37)
3683	H-385-3	2.392 (60.76)	1.420 (36.07)	1.950 (49.53)
3684	H-385-4	2.792 (70.92)	1.820 (46.23)	2.350 (59.69)
3685	H-385-5	3.192 (81.08)	2.220 (56.39)	2.750 (69.85)

H-385 MOUNTING INSTRUCTIONS

- 1. Cut out and drill panel per chart.
- 2. Install snap-in potentiometer².
- Locate silicone boot³ and frame⁴ over potentiometer and holes.
- Attach panel seal assembly to panel with two #6 screws (not supplied).



¹At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.

3400

Part Number*		stance Ω)	Resolution (%)
3400S-1-101	100)	.033
3400S-1-201	200)	.034
3400S-1-501	500)	.023
3400S-1-102	1,0	00	.020
3400S-1-202	2,0	00	.016
3400S-1-502	5,000		.013
3400S-1-103	10,000		.010
3400S-1-203	20,000		.011
3400S-1-503	50,	000	.008
3400S-1-104	100	0,000	.006
3400S-1-204	200	0,000	.005
3400S-1-254	250	0,000	.005
3400S-1-504	500	0,000	.004
Optional Feature		Part	Number
±0.05%		3400	S-41-RC
Ind. Linearity		(1KΩ min.)	

For product specifications, see page 269

3435

Part Number*	Resistance (Ω)	Resolution (%)	
3435S-1-500	50	.415	
3435S-1-101	100	.364	
3435S-1-201	200	.292	
3435S-1-501	500	.274	
3435S-1-102	1,000	.208	
3435S-1-202	2,000	.178	
3435S-1-502	5,000	.135	
3435S-1-103	10,000	.107	
3435S-1-203	20,000	.092	
3435S-1-503	50,000	.057	

For product specifications, see page 279

3437

Part Number*	Resistance (Ω)	Resolution (%)
3437S-1-500	50	.348
3437S-1-101	100	.292
3437S-1-201	200	.236
3437S-1-501	500	.180
3437S-1-102	1,000	.179
3437S-1-202	2,000	.146
3437S-1-502	5,000	.113
3437S-1-103	10,000	.092
3437S-1-203	20,000	.076
3437S-1-503	50,000	.058

For product specifications, see page 278

3437H -HYB

Part Number*	Resistance (Ω)
3437H-HYB-1-201	200
3437H-HYB-1-501	500
3437H-HYB-1-102	1,000
3437H-HYB-1-202	2,000
3437H-HYB-1-502	5,000
3437H-HYB-1-103	10,000
3437H-HYB-1-203	20,000

For product specifications, see page 278

3500

Part Number*	Resistance (Ω)	Resolution (%)
3500S-2-500	50	.058
3500S-2-101	100	.053
3500S-2-210	200	.044
3500S-2-501	500	.033
3500S-2-102	1,000	.030
3500S-2-202	2,000	.024
3500S-2-502	5,000	.018
3500S-2-103	10,000	.019
3500S-2-203	20,000	.015
3500S-2-503	50,000	.011
3500S-2-104	100,000	.008

Optional Feature	Part Number
High Torque	3500S-16-RC
Sealed for Dip Test	3500S-21-RC
±0.1% Ind. Linearity	3500S-42-RC (200 Ω min.)
Voltage Center Tap	3500S-52-RC
AR Pin	3500S-90-RC

For product specifications, see page 270

3501

Part Number*	Resistance (Ω)
3501H-1-102	1,000
3501H-1-202	2,000
3501H-1-502	5,000
3501H-1-103	10,000
3501H-1-203	20,000
3501H-1-503	50,000
3501H-1-104	100,000
Optional Feature	Part Number
High Torque	3501H-16-RC
Sealed for Dip Test	3501H-20-RC
Voltage Center Tap	3501H-50-RC
AR Pin	3501H-91-RC

^{*}The last three digits of the part number represent the resistance value in the standard code. Boldface listings are in stock and readily available through distribution.

3540

Part Number*	Resistance (Ω)	Resolution (%)
3540S-1-101	100	.055
3540S-1-201	200	.042
3540S-1-501	500	.031
3540S-1-102	1,000	.027
3540S-1-202	2,000	.021
3540S-1-502	5,000	.021
3540S-1-103	10,000	.019
3540S-1-203	20,000	.014
3540S-1-503	50,000	.011
3540S-1-104	100,000	.008

Optional Feature	Part Number
High Torque	3540S-16-RC
±0.1% Ind. Linearity	3540S-40-RC (250 Ω min.)
Voltage Center Tap	3540S-52-RC
Rear Shaft Extension	3540S-79-RC
Flatted Shaft	3540S-80-RC
AR Lug	3540S-91-RC
Double Cup	3540S-135-RC/RC

For product specifications, see page 271

3541

Part Number*	Resistance (Ω)
3541H-1-102	1,000
3541H-1-202	2,000
3541H-1-502	5,000
3541H-1-103	10,000
3541H-1-203	20,000
3541H-1-503	50,000
3541H-1-104	100,000
Optional Feature	Part Number
High Torque	3541H-16-RC
±0.1% Ind. Linearity	3541H-40-RC
08 809-1-411	(1K Ω min.)
Voltage Center Tap	3541H-52-RC
Rear Shaft Extension	3541H-79-RC
Flatted Shaft	3541H-80-RC
AR Lug	3541H-91-RC

For product specifications, see page 271

3543

Part Number*	Resistance (Ω)		Resolution (%)
3543S-1-200	20	35	.165
3543S-1-500	50	35	.148
3543S-1-101	100	35	.127
3543S-1-201	200	350	.110
3543S-1-501	500	35	.077
3543S-1-102	1,000 2,000 5,000		.063
3543S-1-202			.062
3543S-1-502			.047
3543S-1-103	10,000		.040
3543S-1-203	20,000 50,000		.031
3543S-1-503			.024
Optional Featu	ire	Part	Number
AR Pin	JUC - F	3543	S-91-RC

For product specifications, see page 272

3545

100	Part Number*		stance	Resolution (%)
7	3545S-1-500	50	phase	.110
	3545S-1-101	100)	.084
	3545S-1-201	200)	.069
	3545S-1-501	500)	.054
	3545S-1-102	1,0	00	.043
	3545S-1-202	2,0	00	.036
	3545S-1-502	5,000		.038
i	3545S-1-103	10,	000	.027
	3545S-1-203	20,	000	.023
S. Arrest	3545S-1-503	50,	000	.016
u G	Optional Feature AR Pin		Part	Number
200			3545S-91-RC	

For product specifications, see page 272

3550

Part Number*	Resistance (Ω)	Resolution (%)
3550S-1-101	100	.058
3550S-1-201	200	.044
3550S-1-501	500	.038
3550S-1-102	1,000	.030
3550S-1-202	2,000	.024
3550S-1-502	5,000	.023
3550S-1-103	10,000	.019
3550S-1-203	20,000	.017
3550S-1-503	50,000	.012
3550S-1-104	100,000	.009
3550S-1-204	200,000	.008

^{*}The last three digits of the part number represent the resistance value in the standard code. Boldface listings are in stock and readily available through distribution.

3551

Part Number*	Resistance (Ω)
3551H-1-102	1,000
3551H-1-202	2,000
3551H-1-502	5,000
3551H-1-103	10,000
3551H-1-203	20,000
3551H-1-503	50,000
3551H-1-104	100,000

For product specifications, see page 273

3560

Part Number*	Resistance (Ω)	Resolution (%)
3560S-1-500	50	.162
3560S-1-101	100	.137
3560S-1-201	200	.115
3560S-1-501	500	.085
3560S-1-102	1,000	.070
3560S-1-202	2,000	.070
3560S-1-502	5,000	.052
3560S-1-103	10,000	.046
3560S-1-203	20,000	.036
3560S-1-503	50,000	.027

For product specifications, see page 274

3561

Part Number*	Resistance (Ω)
3561H-1-501	500
3561H-1-102	1,000
3561H-1-202	2,000
3561H-1-502	5,000
3561H-1-103	10,000
3561H-1-203	20,000

For product specifications, see page 274

3465

Part Number*	Resistance (Ω)	Resolution (%)
3465S-1-500	50	.275
3465S-1-101	100	.217
3465S-1-201	200	.172
3465S-1-501	500	.124
3465S-1-102	1,000	.111
3465S-1-202	2,000	.082
3465S-1-502	5,000	.088
3465S-1-103	10,000	.072
3465S-1-203	20,000	.052
3465S-1-503	50,000	.040
3465S-1-104	100,000	.034

For product specifications, see page 280

3590

Part Number* (Printed Circuit)		Resistance (Ω)	Resolution (%)
3590P-X*-201	3590S-X*-201	200	.039
3590P-X*-501	3590S-X*-501	500	.033
3590P-X*-102	3590S-X*-102	1,000	.029
3590P-X*-202	3590S-X*-202	2,000	.023
3590P-X*-502	3590S-X*-502	5,000	.025
3590P-X*-103	3590S-X*-103	10,000	.020
3590P-X*-203	3590S-X*-203	20,000	.016
3590P-X*-503	3590S-X*-503	50,000	.013
3590P-X*-104	3590S-X*-104	100,000	.009

"X=refer to Shaft/Bushing Table for appropriate configuration number. For product specifications, see page 275

3700

Part Number*	Resistance (Ω)	Resolution (%)
3700S-1-101	100	.081
3700S-1-201	200	.068
3700S-1-251	250	.061
3700S-1-501	500	.048
3700S-1-102	1,000	.043
3700S-1-202	2,000	.035
3700S-1-502	5,000	.034
3700S-1-103	10,000	.026
3700S-1-203	20,000	.021
3700S-1-503	50,000	.017
3700S-1-753	75,000	.013
3700S-1-104	100,000	.013

For product specifications, see page 276

3701

Part Number*	Resistance (Ω)
3701H-1-102	1,000
3701H-1-202	2,000
3701H-1-502	5,000
3701H-1-103	10,000
3701H-1-203	20,000
3701H-1-503	50,000
3701H-1-104	100,000

For product specifications, see page 276

3750

Part Number*	Resistance (Ω)	Resolution (%)
3750S-1-101	100	.081
3750S-1-201	200	.068
3750S-1-251	250	.061
3750S-1-501	500	.048
3750S-1-102	1,000	.043
3750S-1-202	2,000	.035
3750S-1-502	5,000	.034
3750S-1-103	10,000	.026
3750S-1-203	20,000	.021
3750S-1-503	50,000	.017
3750S-1-104	100,000	.013

^{*}The last three digits of the part number represent the resistance value in the standard code. Boldface listings are in stock and readily available through distribution.

3751

Part Number*	Resistance (Ω)
3751H-1-102	1,000
3751H-1-202	2,000
3751H-1-502	5,000
3751H-1-103	10,000
3751H-1-203	20,000
3751H-1-503	50,000
3751H-1-104	100,000

For product specifications, see page 277

6534

Part Number*	Resistance (Ω)
6534S-1-102	1,000
6534S-1-202	2,000
6534S-1-502	5,000
6534S-1-103	10,000
6534S-1-203	20,000
6534S-1-503	50,000
6534S-1-104	100,000

For product specifications, see page 281

6537

Part Number*	Resistance (Ω)
6537S-1-102	1,000
6537S-1-202	2,000
6537S-1-502	5,000
6537S-1-103	10,000
6537S-1-203	20,000
6537S-1-503	50,000
6537S-1-104	100,000

For product specifications, see page 282

6538

Part Number*	Resistance (Ω)
6538S-1-102	1,000
6538S-1-202	2,000
6538S-1-502	5,000
6538S-1-103	10,000
6538S-1-203	20,000
6538S-1-503	50,000
6538S-1-104	100,000

For product specifications, see page 282

6539

Part Number*	Resistance (Ω)	
6539S-1-102	1,000	
6539S-1-202	2,000	
6539S-1-502	5,000	
6539S-1-103	10,000	
6539S-1-203	20,000	
6539S-1-503	50,000	
6539S-1-104	100,000	

For product specifications, see page 283

⁶⁵⁴⁴

Resistance (Ω)
1,000
2,000
5,000
10,000
20,000
50,000
100,000

For product specifications, see page 284

6574

Part Number*	Resistance (Ω)
6574S-1-102	1,000
6574S-1-202	2,000
6574S-1-502	5,000
6574S-1-103	10,000
6574S-1-203	20,000
6574S-1-503	50,000
6574S-1-104	100,000

For product specifications, see page 285

6575

Part Number*	Resistance (Ω)
6575S-1-102	1,000
6575S-1-202	2,000
6575S-1-502	5,000
6575S-1-103	10,000
6575S-1-203	20,000
6575S-1-503	50,000
6575S-1-104	100,000

For product specifications, see page 286

6637 6638

Part Numbers*		Resistance (Ω)
6637S-1-102	6638S-1-102	1,000
6637S-1-202	6638S-1-202	2,000
6637S-1-502	6638S-1-502	5,000
6637S-1-103	6638S-1-103	10,000
6637S-1-203	6638S-1-203	20,000
6637S-1-503	6638S-1-503	50,000
6637S-1-104	6638S-1-104	100,000

For product specifications, see page 287

6639

Part Nu	Part Numbers*	
Bushing Mount	Mechanical Stops	(Ω)
6639S-1-102	6639S-301-102	1,000
6639S-1-202	6639S-301-202	2,000
6639S-1-502	6639S-301-502	5,000
6639S-1-103	6639S-301-103	10,000
6639S-1-203	6639S-301-203	20,000
6639S-1-503	6639S-301-503	50,000
6639S-1-104	6639S-301-104	100,000

^{*}The last three digits of the part number represent the resistance value in the standard code. Boldface listings are in stock and readily available through distribution.

Specifications are subject to change without notice.



6657

Part Number*	Resistance (Ω)
6657S-1-102	1,000
6657S-1-202	2,000
6657S-1-502	5,000
6657S-1-103	10,000
6657S-1-203	20,000
6657S-1-503	50,000
6657S-1-104	100,000

For product specifications, see page 288

6674

Part Number*	Resistance (Ω)
6674S-1-102	1,000
6674S-1-202	2,000
6674S-1-502	5,000
6674S-1-103	10,000
6674S-1-203	20,000
6674S-1-503	50,000
6674S-1-104	100,000

For product specifications, see page 289

3600

The State of the S	Part Number*	Resistance (Ω)	Resolution (%)
ic.	3600S-1-101	100	.057
10	3600S-1-201	200	.047
ì	3600S-1-501	500	.045
M	3600S-1-102	1,000	.035
X	3600S-1-202	2,000	.029
l,	3600S-1-502	5,000	.027
81	3600S-1-103	10,000	.022
	3600S-1-203	20,000	.017
	3600S-1-503	50,000	.013
	3600S-1-104	100,000	.011

For product specifications, see page 290

3610

	Part Number*	Resistance (Ω)	Resolution (%)
1	3610S-1-101	100	.057
1	3610S-1-201	200	.047
	3610S-1-501	500	.045
	3610S-1-102	1,000	.035
1	3610S-1-202	2,000	.029
1	3610S-1-502	5,000	.027
1	3610S-1-103	10,000	.022
1	3610S-1-203	20,000	.017
1	3610S-1-503	50,000	.013
1	3610S-1-104	100,000	.011

For product specifications, see page 291

3640

)	Part Number*	Resistance (Ω)	Resolution (%)
00	3640S-1-101	100	.048
101.3 Yaza	3640S-1-201	200	.041
- 101	3640S-1-501	500	.031
non	3640S-1-102	1,000	.030
000	3640S-1-202	2,000	.021
nno i	3640S-1-502	5,000	.016
-zentin-	3640S-1-103	10,000	.019
	3640S-1-153	15,000	.016
	3640S-1-203	20,000	.013
	3640S-1-503	50,000	.010
	3640S-1-753	75,000	.009
	3640S-1-104	100,000	.008
OI.	3640S-1-254	250,000	.006

For product specifications, see page 292

3650

Part Number*	Part Number* Resistance (Ω)	
3650S-1-101	100	.048
3650S-1-201	200	.041
3650S-1-501	500	.031
3650S-1-102	1,000	.030
3650S-1-202	2,000	.021
3650S-1-502	5,000	.016
3650S-1-103	10,000	.019
3650S-1-153	15,000	.016
3650S-1-203	20,000	.013
3650S-1-503	50,000	.010
3650S-1-753	75,000	.009
3650S-1-104	100,000	.008

For product specifications, see page 293

3680

Resistance (Ω)	3681S-1 1 Decade	3682S-1 2 Decade	3683S-1 3 Decade	3684S-1 4 Decade	3685S-1 5 Decade
50	-500	600			
100	-101	608			
200	-201	Lent-	2000 40		
500	-501	-501	-25123		
1,000	-102	-102	-102		
2,000	-202	-202	-202		
5,000	-502	-502	-502	as which As work	
10K	-103	-103	-103	-103	
20K		-203	-203	-203	
50K		-503	-503	-503	
100K	-104	-104	-104	-104	-104
500K			-504	-504	-504
1 Meg		-105	-105	-105	-105



DEFINITIONS AND TEST PROCEDURES

Cermet Elements

Cermet elements are available in a wide range of resistance values and tapers. They offer essentially infinite resolution and excellent stability in the most severe environmental conditions. Static and dynamic noise (CRV) performance is good but not as good as that of conductive plastic.

The temperature coefficient of cermet elements, though not as good as wirewound elements, is better than conductive plastic or carbon type elements. Linearity is quite good for a film type element and can be improved considerably for greater dial setting accuracy by laser tailoring.

Frequency response of cermet materials is very good and the practical application range extends well beyond 100 MHZ.

Conductive Plastic Elements

Conductive plastic is a thick film ink, similar to cermet, but has a smoother surface. This characteristic offers several operational advantages over cermet. Dynamic noise characteristics (CRV or output smoothness) and rotational life are measurably improved as a result of the

surface smoothness. Resolution is essentially infinite.

Conductive plastic elements are generally available in a wide range of resistance values and tapers.

Moisture resistance, temperature coefficient, power dissipation and wiper current capacity for conductive plastic elements are not as good as cermet elements.

Wirewound Elements

Wirewound elements offer good stability, excellent linearity, low noise, high power capabilities and good operational life.

Wirewound elements offer a wide selection of resistance values up to 500k ohms.

One primary limitation of wirewound elements is the finite resolution steps, which result from the wiper moving from turn to turn. (These steps are distinct, sudden, repeatable changes in output.) Resolution improves as resistance values increase due to the manufacturing processes whereby smaller wire and a higher number of turns are utilized.

In systems that might be sensitive to such discrete steps, care should be taken to select an element with resolution fine enough to avoid difficulty. The many turns of resistance wire exhibit an inductive reactance that increases directly with frequency. This effect is most noticeable in low total resistance elements because the inductive reactance can be larger than the resistance, even at frequencies as low as 20KHZ.

The performance of wirewound elements is also affected by inherent capacitance. Capacitance exists from turn to turn and also between the winding and the mandrel. Capacitance effects are most significant in high total resistance elements.

Hybritron® Elements

This element is a combination of a wirewound element with a conductive plastic coating. It exhibits the temperature coefficient and resistance stability approaching a pure wirewound element. It displays the long operational life, essentially infinite resolution and low noise characteristics of the pure conductive plastic elements. The combination of the two provides the major benefits of both types of elements. Not recommended in applications requiring high wiper currents.

CAUTION: CONDUCTIVE PLASTIC AND HYBRITRON® ELEMENTS SHOULD BE APPLIED IN VOLTAGE DIVIDER CIRCUITS ONLY.

Absolute Minimum Resistance

DEFINITION

The resistance measured between the wiper terminal and either end terminal when the wiper is positioned to give a minimum value on the measuring device.

TEST PROCEDURE

The wiper shall be positioned at one end of the resistance element so that a minimum value of resistance shall be measured as specified between the wiper and the corresponding end terminal. The same procedure shall be followed for the opposite end of the resistance element.

Contact Resistance Variation (CRV)

DEFINITION

The apparent resistance seen between the wiper and the resistance element when the wiper is energized with a specified current and moved over the adjustment travel in either direction at a constant speed. The output variations are measured over a specified frequency bandwidth, exclusive of the effects due to roll-on or roll-off of the terminations and expressed in ohms or percent of total resistance.

test procedure CRV shall be t

CRV shall be tested using the circuit as shown in Fig. 1 on page 253 of Potentiometer Handbook (or its equivalent). The operating shaft shall be rotated in both directions through 90% of the adjustment travel for a total of 6 cycles. Only the last 3 cycles shall count in determining whether or not a contact resistance variation is observed at least twice in the same area (within 5%),

exclusive of the roll-on or roll-off points where the wiper moves from the termination, on or off, the resistance element. The rate of rotation of the operating shaft shall be such that the wiper completes 1 cycle in 5 seconds, minimum, to 2 minutes, maximum. The test current used shall be in accordance with the table below, unless otherwise specified.

Test Current

(±20%)	Total Resistance Range
30 ma	50 Ohms
10 ma	= or >50 Ohms to <500 Ohms
1 ma	= or >500 Ohms to <100K Ohms
100 ua	= or >100K Ohms to <2 Megohms
50 ua	= or >2 Megohms



DEFINITIONS AND TEST PROCEDURES

Dielectric Withstanding Voltage

DEFINITION

The ability to withstand under prescribed conditions, a specified potential of a given characteristic between the terminals of each cup and exposed conducting surface of the potentiometer, or between the terminals of each cup and the terminals of every other cup in the assembly without exceeding a specified leakage current value.

TEST PROCEDURE

The magnitude of the test voltage shall be specified. Connect the equipment by applying the high voltage source between the potentiometer terminals (interconnected) and the shaft or case. Raise the test voltage from zero to the proper maximum value at a rate of 500 volts per second maximum. Maintain the test voltage at this level while operating the shaft through one full sweep of its mechanical travel in a time interval of not less than 5 seconds nor more than 60 seconds. Monitor the leakage current indicating device throughout this test for evidence of damage, arcing, breakdown, or leakage current in excess of 1 milliampere. Upon completion of the test, prior to disconnecting the leads, gradually reduce the test voltage to zero.

For ganged potentiometers, repeat the foregoing applying the high voltage between the terminals of each cup and the terminals of every other cup on the potentiometer under test.

Equivalent Noise Resistance (ENR)

DEFINITION

Any spurious variation in the electrical output not present in the input, defined quantitatively in terms of an equivalent parasitic transient resistance in ohms, appearing between the contact and the resistance element when the shaft is rotated or translated. The equivalent noise resistance is defined independently of the resolution, the functional characteristics, and the total travel. The magnitude of the equivalent noise resistance is the maximum departure from a specified reference line. The wiper of the potentiometer is required to be excited by a specified current and moved at a specified speed.

TEST PROCEDURE

The potentiometer shaft is cycled not less than ten times over a minimum of 95% of the electrical continuity travel within the rated travel speed of the potentiometer just prior to making noise measurements. The potentiometer shaft is then connected mechanically to the constant speed drive and electrically connected to the test circuit. With the constant speed drive engaged, the potentiometer noise characteristic may then be noted on the oscilloscope as the wiper traverses one complete cycle over the full electrical continuity travel and the maximum values are compared to the specified limit.

If only random spikes of noise are noted, the potentiometer should be cycled again. If the random spikes are repetitive, the maximum values should be noted. Otherwise do not consider the initial measurements as noise.

Independent Linearity

DEFINITION

The maximum deviation expressed as a percent of the total applied voltage, of the actual function characteristic from a straight line whose slope and position minimize the maximum deviations over the actual electrical travel, or any specified portion thereof.

TEST PROCEDURE Consult factory.

Insulation Resistance

DEFINITION

The resistance to a specified impressed DC voltage between the terminals of each cup and the exposed conducting surfaces of the potentiometer, or between the terminals of each cup and the terminals of every other cup in the gang, under prescribed conditions.

TEST PROCEDURE

Interconnect all electrically insulated terminals of each cup of the potentiometer. Connect the insulation resistance test set to the terminal of the first cup and to some exposed conducting surface (shaft, housing, etc.) and apply the specified test voltage. Unless otherwise specified the test voltage shall be 500 VDC. Maintain the test voltage at this level for 5 to 10 seconds before initiating movement of the shaft through one full sweep of the total mechanical travel in a time interval of not less than 5 seconds nor more than 60 seconds. Monitor the indicated insulation resistance during this voltage application, the insulation resistance is the minimum value observed during the movement of the shaft.

For ganged potentiometers, repeat the procedure for each cup applying the high voltage between the terminal of each cup and the exposed conducting surface of the potentiometer.



DEFINITIONS AND TEST PROCEDURES

Output Smoothness

DEFINITION

The spurious variations in the electrical output not present in the input. They are measured for specified travel increments over the theoretical electrical travel and expressed as a percentage of the total applied voltage.

TEST PROCEDURE

Mount the potentiometer in the constant-speed drive (4 RPM) and excite it with the power supply. Connect the wiper and the power common lead to the input of the filter and the output of the filter to the oscilloscope. When a load is specified for a conformity test, use that load for the output smoothness test. When no load is specified for the conformity test, apply a load equal to 100

times the nominal resistance value of the potentiometer under test between the wiper and the CCW end (unless otherwise specified).

The output smoothness is the largest excursion voltage occuring over one specified travel increment, divided by the total applied voltage. Unless otherwise specified, the travel increment is 1% of the theoretical electrical travel.

Excursions occurring at the point of abrupt changes in input slope (start, end, and reversal) are not considered output smoothness faults.

Power Rating

DEFINITION

The maximum power, in watts, that a potentiometer can dissipate across the entire resistive element under specified conditions while meeting specified operating performance requirements.

Resolution

DEFINITION

A measure of the sensitivity to which the output of a potentiometer may be set. (Applicable to wirewound potentiometers only.)

Theoretical resolution; the reciprocal of the number of turns of wire in the resistance winding in the actual electrical travel, expressed as a percentage.

Travel resolution; the maximum value of shaft travel (in

degrees for rotary devices) in one direction per incremental voltage stop in any specified portion of the resistance element.

Voltage resolution; the maximum incremental change in output ratio with shaft travel in one direction in any specified portion of the resistance element.

TEST PROCEDURE

Consult factory.

Temperature Coefficient of Resistance

DEFINITION

The unit change in resistance per degree Celsius change from a reference temperature, expressed in parts per million per degree Celsius using the following formula:

 $TC = [(R1-R2)/R1(T2-T1)] \times 106$

WHERE: R1 = Resistance at reference temperature in ohms

R2 = Resistance at test temperature in ohms

T1 = Reference temperature in degrees Celsius

T2 = Test temperature in degrees Celsius

TEST PROCEDURE

Position the wiper of the potentiometer to be tested off of the actual electrical travel or at a point to minimize the total resistance if no over travel exists. Subject the potentiometer to the specified test temperature(s). The total resistance is measured after temperature chamber has been stabilized for the test temperature for a minimum of 30 minutes (avoid over aging). The reference temperature of 25 degree Celsius shall be used for all elevated and reduced temperatures. Calculate the (TC) by inserting the appropriate data into the above formula and comparing the result to the specification.

Total Resistance

DEFINITION

The DC resistance between the end terminals of a potentiometer with the shaft positioned so as to give a maximum resistance value.

TEST PROCEDURE

With the VOM or DVM device (10ma maximum current) connected between the wiper and one end terminal, position the

wiper onto the electrical overtravel. Reconnect the test leads of the measuring device to the end terminals of the potentiometer under test, the reading observed is the total resistance of the potentiometer.



LINEAR MOTION POTENTIOMETER

- Compact
- Lightweight
- Long life
- Infinite resolution
- Free shaft rotation
- AC or DC

- Shaft options available
- Flexible wire leads

Model 3048

Bourns® Linear Motion Potentiometer

Specifications*

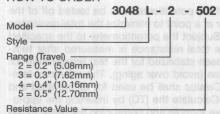
Independent Linearity±5%
ResolutionInfinite
Power Rating0.25 watt
@ 70°C (158°F)
Operating Temperature Range

.....55°C to +125°C
Insulation Resistance.....50 megohms
@ 500 VDC
BacklashNegligible
Shaft Actuating Force4 oz. max.
@ 70°F

Life500,000 cycles Shock50G for 6msec Vibration20G, 20-20,000 Hz MarkingManufacturer's trademark, resistance code, wiring diagram, date code, manufacturer's model number and style

Specifications are typical. Contact factory for special requirements. *Specifications applicable from 5% to 95% of electrical travel.

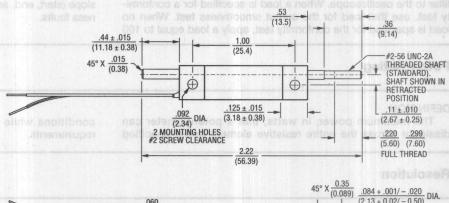
HOW TO ORDER

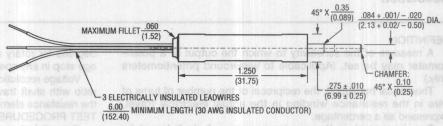


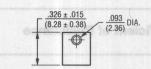
STANDARD RESISTANCE TABLE

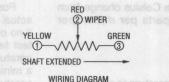
Resistance (Ohms)	Resistance Code
2,500	252
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1.000.000	105

Popular values listed in boldface. Special resistances available.





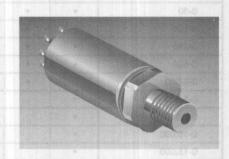




TOLERANCES: $\pm \frac{.010}{(0.25)}$ EXCEPT WHERE NOTED DIMENSIONS: $\frac{IN.}{(MM)}$

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Custom Products

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- · Mounted and Gel Isolated
- Custom Packages

SILICON PRESSURE DIE

- 2 to 5000 PSI
- 0.25% Linearities
- Excellent Stability

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- · MAP
- Transmission
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APPLIANCE & HVAC

- High Volume
- Custom Designs
- Ceramic Sensors
- Silicon Sensors

Industrial Sapphire Sensor (Available Mid '95)

FEATURES

- 1/2% FS and 1/4% FS Accuracies
- Six Different Pressure Connections
- Four Different Electrical Connections
- 4-20mA Current Versions
- Voltage Outputs: 0-5, 0-10, 1-5, 1-6
- Corrosive Media Compatiblity
- Pressure Ranges to 5000 PSI
- Applications:
 - Pumps and Compressors
 - Process Control
 - Refrigeration
 - Machine Tools

Page No.



PRODUCT SELECTION GUIDE Sapphire Sensors™

Characteristic	DSS100	ST3100	ST3110	ST3130	ST3140	ST3200	ST3210	ST3230	ST3240	ST3300	ST3400	ST5020
Pressure Ranges - PSI: 0-15			1908		•			per k	sd-XA	A thate	w all	•
0-25	•	•					villi e					
0-50		•						enoites	Specifi	toubo	9	
0-100	•	•	300			Sensor	enirias	Ital Sa	piQ 001	DSS		
0-250	•	•	310	•	ensor	2 Havili	M voe	moA n	olH 00	ST3		
0-500	•	•	91.6	•		Senso	erature	mail r	old or	18T8		•
0-2,500			Q+D	•	ientor	2 AmiOS	-A voe	uno Aid	30 Hin	STS		
0-5,000	•		919		Senso	beition	A tos	A P	40 Hig	STS		
0-7,500			A P.C.		10205	2 thouil	iM tanie	pat9 s	nii-£00	SET 92	•	•
0-10,000		Faller :	ALC			nerta?	ani itema	armaT d	nil-*01	SETTE		
0-15,000			arg		noshe	2 A•n0	2-A terres	n Pterce	nil-•ne	ST30		
0-20,000			710		Senso	neitinn	A Page	1000	nil- ni	PETE		
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0.10										THE STATE OF		
0.05			100 19							(FURLISH)		7 (211 - 1911)
0.02			1901-17							Herita I		
Thermal: Compensated												
Uncompensated		•		310							•	
Electrical Output: 5mV/V	Digital			7 1		1.						
4-20 mA	29/2/11	HATTE	2 100	•	1250100	**	Day (A.)	•	U de s		71 31 11	
0-5 VDC		2.14		SPHU	AU.			SORS	VES EL	HESSU	H MOOR	Jie.
0-10 VDC	ACCUE	/435 Ft	Drie 85	172270						300 PS	QU.S. 4	
Pressure Port: 1/8" NPT-M	See Data Sheet	onuase cint•ial=	Harona P	SIX DII				Defficie	d Capilis	See Data Sheet	See Data Sheet	See Dat Sheet
1/4" NPT-M	and	iana•V to	emu.O.A	m09-A-								
MS-33656-4G	- Front-o	2.0	unitOs	maten/					BE DIE	112231	EL MOKON	112
1/4"-18 NPT-F	whilditen	in Core	bellit pui	Сотго					• 15	ig anga	ALC .	
Electrical Connection: Connector Lugs	See Data Sheet	es to 5	re Rang	Pressu					dties	eniul &	e 0.25	
PT1H-10-6P			18/10/56						villids.	10 3110		
3/4"-14 NPT-M	BUES ION	our brus	postu-					1				
Leadwires		OBNOC:	1000011	•					anoai	30.34		
Operating Temperature: -65°F to +255°F		alcon Tools	Nachigo Machin							oisaims	TIETT .	
-65°F to +500°F									10000	rel Gas	riski •	
-40°F to +185°F	•						Bra V					
0°F to +750°F									10/	WHEE	DIVALLE	QA .
Enclosure: NEMA 4X									•	mulav	igdi e	
Explosion Proof		7 11 2 1 1								op sim	100	•
NEMA 2									2011221	ano2 no	119U A	
Availability	3Q '95	Now	2Q '95	2Q '95	3Q '95	2Q '95	2Q '95	2Q '95	3Q '95	4Q '95	2Q '95	2Q '95
Page No.	308	310	311	312	313	314					319	320



PRESSURE SENSOR **DESIGN REVIEW CENTER**

We would like to provide you with the best possible solution for your application. Simply take a minute to complete the key design parameters listed below, make a copy of this page, and FAX to (909) 781-5178.

Name						
Cumulative to						
Company						
Telephone					boA	
EAV	ducere	ranat c	Aug.	Proc	Famus	

Briefly Describe Your Application:

Maximum Pressure in PSI:	ressure in PSI:	Maximum
--------------------------	-----------------	---------

- **1**5 □ 3000
 - □ 5000
- □ 50 7500
- 100
- □ 250 □ 500 20,000
 - **1**000

Accuracy Requirement:

- □ 1.0%
- □ 0.5%
- **□** 0.25% **□** 0.20%

Electrical Output Requirement:

☐ Other (Please specify): _

- □ 5mV/V
- □ 4-20mA
- □ 0-5VDC
- □ 0-10VDC

Desired Pressure Port:

- □ 1/8" NPT-M
- □ 1/4" NPT-M
- ☐ MS-33656-4G
- □ 1/4"-18 NPT-F

Desired Electrical Connection:

- ☐ Solder Lugs
- □ PT1H-10-6P
- □ 3/4"-14 NPT-M
- □ Leadwires

Operating Temperature:

- □ -65°F to +255°F
- □ -65°F to +500°F
- □ -40°F to +185°F

Fluid to be Measured:

- □ water
- air air
- ☐ flammable fluid ☐ corrosive fluid

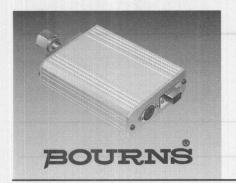
☐ Other (Please specify):

Upon Completion, FAX to (909) 781-5178



1200 Columbia Avenue Riverside, CA 92507-2114 (909) 781-5148

For Immediate Applications Assistance, Call: 1-800-X-DUCERS



DIGITAL SAPPHIRE SENSORTM

- Reprogrammable intelligent sensing device
- Sapphire diaphragm
- 0.02% and 0.05% FS accuracies
- Binary output
- Snapshot/store pressure reading
- Cumulative MIN/MAX pressure storage registers-software resettable
- Hi/lo temperature control limits with output function

Model DSS100

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges

.....0-15 to 0-20,000 PSI

Accuracy Class:

	±0.05%FS	±0.02%FS
Linearity	±0.02	±0.005
Repeatability	±0.02	±0.01
Hysteresis	±0.015	±0.01
Thermal Effects (%FS/°F):		
Zero	±0.001	±0.0005
Span	±0.001	±0.0005
Proof Pressure.		150%
Burst Pressure		200%

Electrical Specifications

Strobe	Interface	TTL/CMOS
		compatible

Circuit to Case Insulation

Resistance.....>500 megohms @ 50 VDC

Power Requirements

Voltage+12.	.5 VDC to +16.5 VDC
Current	Less than 100 mA
Response Time	Less than 1.0ms

Environmental Conditions

remperature	
Compensated	40°F to +185°F
Storage	65°F to +250°F
Operating	40°F to +185°F
	0% to 90%
	non-condensing
(:	splash resistant case)
Media Compatibility	All liquids and
gases compat	tible with 15-5 Ph SS,
glass, 96%	alumina and sapphire

Physical Specifications

Enclosure	Epoxy coated
	aluminum case
Weight	Less than 12 oz.

DESCRIPTION

The Bourns Model DSS100 Pressure Transducer combines Bourns' advanced Sapphire Sensor technology with state-of-the-art microprocessor-based electronics to create the latest in totally digital transducers.

This is not simply an analog converted signal using standard A to D converters. This is a whole new way to digitally power the sensing element to obtain a completely digital sensor and electronics. This unique method provides performance, ease of use and stability never before available.

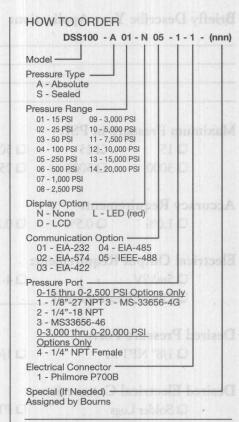
The Bourns Sapphire Sensor technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's near perfect, single crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis.

The Model DSS100 Sapphire
Pressure Transducer is ideally suited for use as a secondary standard in test equipment and applications where extreme accuracy and temperature stable measurement is required.

Offered in a wide variety of digital output formats and pressure ranges the DSS100 is designed to be user-friendly.

FUNCTION

All the features of the DSS100 are user-friendly software driven in order to achieve the greatest usefulness of this multi-function transmitter.



Optional Device Drivers
Available for test and measurement packages (e.g., LabviewTM,
Hewlett Packard VEETM).

APPLICATIONS

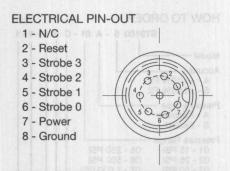
- Chemical processing
- Pumps and compressors
- Well data logging
- Offshore exploration
- Pipelines
- Water and wastewater systems
- Power generation
- Oil and gas processing
- Gas transmission
- Calibration Systems
- Metrology labs
- Environmental monitoring

- Oceanography
- Laboratory standards
- Meteorology
- Wind tunnels
- Level sensing
- Flow measurement
- Leak testing
- Medical equipment
- Automated test stands
- Pilot plant
- Flight test

- Remote software zero and span
- Baud rates from 300 to 38400
- Square root functions for flow calculations
- Programmable in any engineering units
- Multiple units addressable
- Resolution down to 1PPM
- Parameters stored in non-volatile EEPROM

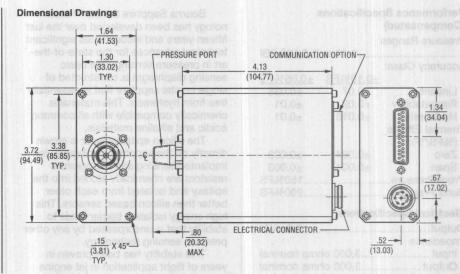
Model DSS100

Bourns® Pressure Transducers

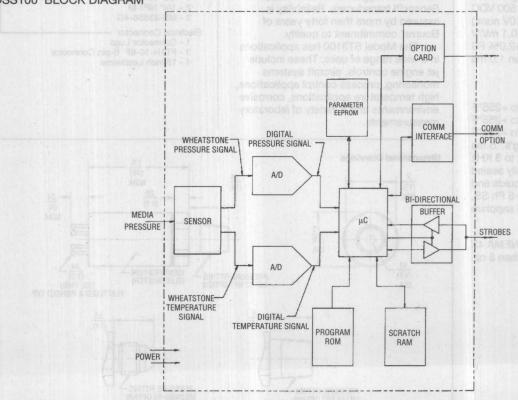


PIGGYBACK CARD OPTIONS

- A) LCD Pressure/Temperature Display
- B) LED Pressure/Temperature Display
- C) Pressure/Temperature Controller
- D) Modem (Receive/Generate Phone Messages)



DSS100 BLOCK DIAGRAM





HIGH ACCURACY MILLIVOLT SAPPHIRE SENSORTM

- ±0.10% and ±0.05% FS accuracies
- Corrosion resistant sapphire diaphragm
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments

■ Fast response time

- Small size
- Excellent long-term stability

Model ST3100 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges

.....0-15 to 0-2,500 PSI

Accuracy Class:

	±0.10%FS	±0.05%FS
Linearity	±0.07	±0.035
Repeatability	±0.02	±0.01
Hysteresis	±0.015	±0.01
Thermal Effects (%FS/°F):		
Zero	±0.004	±0.003
Span	±0.004	±0.003
Proof Pressure		150%FS
Burst Pressure		200%FS

Electrical Specifications

5.0mV/V
3,000 ohms nominal
3,000 ohms nominal
ation
>500 megohms @
500 VDC
5-15 VDC (10V nom.)
±0.1 mV/V
±2.0% FS
Less than 1.0 ms

Environmental Conditions

Temperature
Compensated65°F to +255°F
Storage65°F to +255°F
Operating65°F to +255°F
Shock100g's, .5 ms
Vibration6g's, 10 Hz to 3 KHz
HumidityHermetically sealed
Media CompatibilityAll liquids and
gases compatible with 15-5 Ph SS,
glass 96% alumina and sannhire

Physical Specifications

Enclosure		.NEN	1A	4X
Weight	Less	than	3	oz.

Bourns Sapphire Sensor™ technology has been developed over the last fifteen years and incorporates significant technical advances for the state-of-theart in pressure sensing. The basic sensing diaphragm is constructed of single crystal sapphire that is essentially free from hysteresis. This material is chemically compatible with all common acidic and alkaline materials.

The silicon epitaxial layer is grown directly on the sapphire diaphragm. Ion implanted sensing and temperature resistors are chemically etched into the epitaxy and isolated from each other better than silicon based sensors. This high energy isolation barrier leads to stability that is unsurpassed by any other pressure sensing technology.

This stability has been proven in years of flight application in jet engine controls. Literally millions of hours of use have been logged on Bourns' Sapphire Sensor™ transducers. Reliability is assured by more than forty years of Bourns' commitment to quality.

The Model ST3100 has applications in a wide range of uses. These include jet engine controls, aircraft systems monitoring, process control applications. high temperature applications, corrosive environments and a variety of laboratory measurements.



5 - ±0.05% FS Pressure Type

A - Absolute S - Sealed

Pressure Range 01 - 15 PSI 02 - 25 PSI 05 - 250 PSI 06 - 500 PSI 03 - 50 PSI 07 - 1,000 PSI 04 - 100 PSI - 2.500 PSI

Thermal Compensation

C - Compensated U - Uncompensated Electrical Output

Output Offset 0 - Standard Offset

Output Full Scale 5 - 5mV/V Full Scale

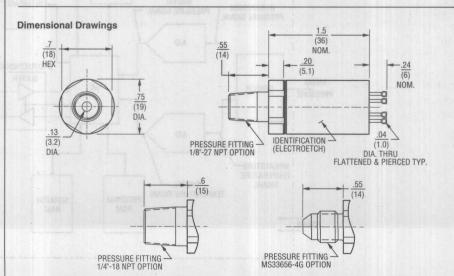
Pressure Port · 1 - 1/8" NPT-M 2 - 1/4" NPT-M

3 - MS-33656-4G

Electrical Connector

1 - Connector Lugs 2 - PT1H-10-6P 6-pin Connector

4 - 18 Inch Leadwires





HIGH TEMPERATURE SAPPHIRE SENSOR™

- ±0.20% and ±0.10% FS accuracies
- Temperatures up to 500°F
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments

- Fast response time
- Small size
- Excellent long-term stability
- Unamplified millivolt output

Model ST3110 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Uncompensated)

Pressure Ranges

.....0-15 up to 0-2,500 PSI

Accuracy Class:

loodido, cidoo.		
	±0.20%FS	±0.10%FS
Linearity	±0.15	±0.07
Repeatability	±0.03	±0.01
Hysteresis	±0.02	±0.01
Thermal Effects		
(%FS/°F):		
Zero	±0.03	±0.025
Span	±0.07	±0.06
Proof Pressure	4 000,3 - 60	150%FS
Burst Pressure		200%FS

Electrical Specifi	cations
Output	8.0mV/V
Impedance	
Input	3,000 ohms nominal
Output	3,000 ohms nominal
Circuit to Case Ins	sulation
Resistance	>500 megohms @
	500 VDC
Input Voltage	5-15 VDC (10V nom.)
	±10.0% FS
Span Tolerance	±25.0% FS
Response Time	Less than 1.0 ms

Environmental Conditions

-	
lem	perature

Storage-65°F to +500°F Operating-65°F to +500°F Shock......100g's, .5 ms Vibration6g's, 10 Hz to 3 KHz Humidity.....Hermetically sealed Media CompatibilityAll liquids and gases compatible with 15-5 Ph SS, glass, 96% alumina and sapphire

Physical Specifications

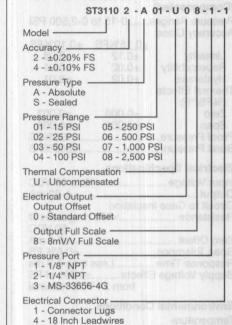
Enclosure		.NEN	IA	4X
Weight	Less	than	3	oz.

The Bourns Model 3110 Pressure Transducer utilizes Bourns' advanced high-temperature Sapphire Sensor technology. The new Model ST3110 offers accuracy never before available in a high-temperature transducer.

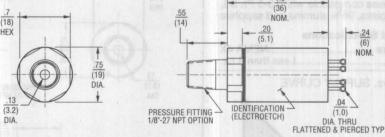
Bourns Sapphire Sensor technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages are molecularly attached to the sensing diaphragm to form a homogeneous sensor that establishes a new benchmark in long term stability.

The Model ST3110 Sapphire Pressure Transducer is ideally suited for use in down-hole, aerospace, medical and testing applications where a highly accurate, stable measurement is required. The Model ST3110 is compatible with many common corrosive fluids. Consult Bourns application specialists for complete compatibility specifications. Constructed of stainless steel, these models provide reliable long-life service and convenient installation.

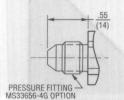
HOW TO ORDER



Dimensional Drawings









HIGH ACCURACY 4-20 mA SAPPHIRE SENSOR™

- ±0.15% and ±0.10% FS accuracies
- Corrosion resistant sapphire diaphragm
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments
- Fast response time
- Small size
- Excellent long-term stability
- Two wire 4-20 output

Model ST3130 Series

Bourns® Pressure Transmitters

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges......0-15 to 0-2,500 PSI Accuracy Class: ±0.15%FS ±0.10%FS Linearity ±0.12 ±0.08 Repeatability ± 0.02 ±0.01 Hysteresis ±0.02 ±0.01 Thermal Effects (%FS/°F): Zero ±0.006 ±0.003 Span ±0.006 ±0.003 Proof Pressure.... 150%FS Burst Pressure.....200%FS

Electrical Specifications

Electrical Specificat	ions
Input Voltage	12 to 36 VDC
Output	4-20 mA
Circuit to Case Insula	tion many money
Resistance	
	50 VDC
Zero Offset	±0.1 mA
Span Tolerance	±0.6% FS
Response Time	
Supply Voltage Effect	
fr	om 24 VDC nominal

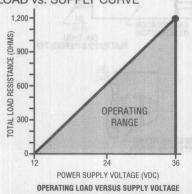
Environmental Conditions

Temperature	
Compensated	40°F to +185°F
Storage	65°F to +250°F
	40°F to +200°F
	100g's, .5 ms
Vibration	6g's, 10 Hz to 3 KHz
Humidity	Hermetically sealed
Media Compatibili	tyAll liquids and
gases comp	atible with 15-5 Ph SS,
glass, 96%	alumina and sapphire

Physical Specifications

Enclosure	NEMA 4X
Weight	Less than 3 oz.

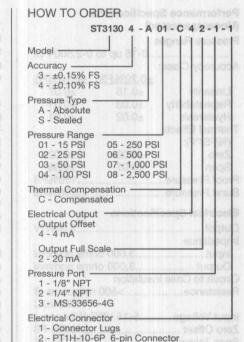
LOAD vs. SUPPLY CURVE



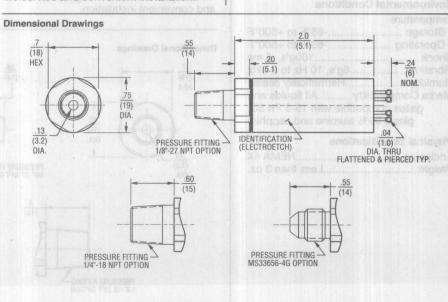
The Bourns Model ST3130 Pressure Transmitter utilizes Bourns' advanced Sapphire Sensor™ technology. The new Model ST3130 offers unparalleled accuracy and reliability in a rugged 4-20 mA Transmitter.

Bourns Sapphire Sensor™ technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages are molecularly attached to the sensing diaphragm to form a homogeneous sensor that establishes a new benchmark in long-term stability.

The Model ST3130 Sapphire
Pressure Transmitter is ideally suited for use in down-hole data logging, and in the measurement of liquid and gas pressures where a highly accurate, stable measurement with a 4-20 mA output is needed. The Model ST3130 is compatible with many common corrosive fluids. Constructed of stainless steel, these models provide reliable long-life service and convenient installation.



3 - 18 Inch Leadwires





HIGH ACCURACY AMPLIFIED SAPPHIRE SENSORTM

- ±0.15% and ±0.10% FS accuracies
- Excellent performance over temperature
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments
- Lightweight
- Small size
- Excellent long-term stability
- 0-5 VDC output

Model ST3140 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges......0-15 to 0-2,500 PSI Accuracy Class:

±0.15%FS ±0.10%FS

Linearity	±0.12	±0.08
Repeatability	±0.02	±0.01
Hysteresis	±0.02	±0.01
Thermal Effects (%FS/°F):		
Zero	±0.006	±0.003
Span	±0.006	±0.003
Proof Pressure		150%FS
Burst Pressure		200%FS

Electrical Specifications
Input Voltage5 to 15 VDC
Output5.0 VDC
Minimum Load> 1,000 ohms
Circuit to Case Insulation
Resistance>500 megohms @
50 VDC
Zero Offset±100 mV
Span Tolerance±2.0% FS
Response Time80 Hz Filter
Supply Voltage Effects±0.3% of FS
from 12 VDC nominal

Environmental Conditions

Temperature Compensated-40°F to +185°F Storage-65°F to +250°F Operating-40°F to +200°F Shock......100g's, .5 ms Vibration6g's, 10 Hz to 3 KHz Humidity.....Hermetically sealed Media CompatibilityAll liquids and gases compatible with 15-5 Ph SS, glass, 96% alumina and sapphire

Physical Specifications

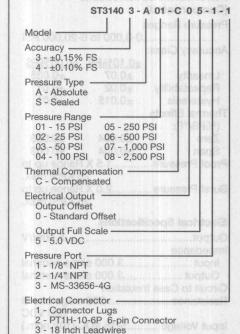
Enclosure	NEMA 4X
Weight	Less than 3 oz.

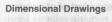
The Bourns Model ST3140 Pressure Transducer utilizes Bourns' advanced Sapphire Sensor™ technology. The new Model ST3140 offers unparalleled accuracy and reliability in a rugged 0 to 5 VDC Transducer.

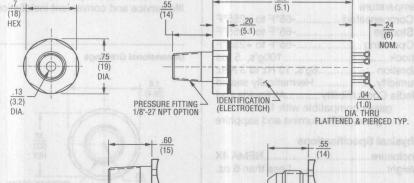
Bourns Sapphire Sensor™ technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages are molecularly attached to the sensing diaphragm to form a homogeneous sensor that establishes a new benchmark in longterm stability.

The Model ST3140 Sapphire Pressure Transducer is ideally suited for use in down-hole data logging, and in the measurement of liquid and gas pressures where a highly accurate, stable measurement with a 4-20 mA output is needed. The Model ST3140 is compatible with many common corrosive fluids. Constructed of stainless steel, these models provide reliable longlife service and convenient installation.

HOW TO ORDER









HIGH PRESSURE MILLIVOLT SAPPHIRE SENSOR™

- ±0.10% and ±0.05% FS accuracies
- Corrosion resistant sapphire diaphragm
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments
- Fast response time
- Small size
- Excellent long-term stability

Model ST3200 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges

.....0-3,000 to 0-20,000 PSI

Accuracy Class:

±0.10%FS	±0.05%FS
±0.07	±0.035
±0.02	±0.01
±0.015	±0.01
±0.004	±0.003
±0.004	±0.003
1.5 X	Range up to
2	5 KPSI max.
2.0 X	Range up to
2	5 KPSI max.
	±0.07 ±0.02 ±0.015 ±0.004 ±0.004 1.5 X 2

Electrical Specifications

Output	5.0mV/V
Impedance	
	3,000 ohms nominal
Output	3,000 ohms nominal
Circuit to Case Ins	
Resistance	>500 megohms @
	500 VDC
Input Voltage	5-15 VDC (10V nom.)
Zero Offset	±1.0 mV/V
Span Tolerance	±1.0% FS
	Less than 1.0 ms

Environmental Conditions

Temperature	
Compensated	65°F to +255°F
	65°F to +255°F
Operating	65°F to +255°F
Shock	100g's, .5 ms
Vibration	6g's, 10 Hz to 3 KHz
Humidity	Hermetically sealed
Media Compatibilit	yAll liquids and
gases compa	atible with 15-5 Ph SS,
glass, 96%	alumina and sapphire

Physical Specifications

Enclosure		.NEM	IA	4X
Weight	Less	than	6	oz.

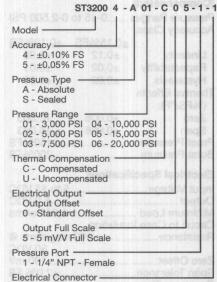
The Bourns Model 3200 Pressure Transducer utilizes Bourns' advanced high-pressure Sapphire Sensor technology. The new Model ST3200 offers accuracy and reliability never before available in a high-pressure transducer.

Bourns Sapphire Sensor technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages offer high sensitivity and low-noise levels to meet even the most demanding applications.

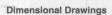
The sapphire sensor does not suffer from creep or fatigue, a common problem in most high-pressure strain gage transducers.

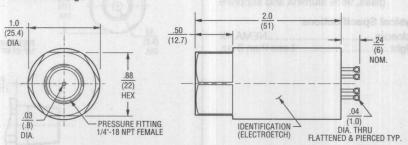
The Model ST3200 Sapphire Pressure Transducer is ideally suited for use in down-hole, aerospace, oceanography and testing applications where a highly accurate, stable measurement is required. The Model ST3200 is compatible with many common corrosive fluids. Consult Bourns application specialists for complete compatibility specifications. Constructed of stainless steel, these models provide reliable longlife service and convenient installation.

HOW TO ORDER



- 2 PT1H-10-6P 6-pin Connector
- 4 18 Inch Leadwires







HIGH TEMPERATURE SAPPHIRE SENSOR™

- ±0.20% and ±0.10% FS accuracies
- Pressures up to 20,000 PSI
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments
- Fast response time
- Small size
- Excellent long-term stability

Model ST3210 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Uncompensated)

Pressure Ranges

.....0-3,000 to 0-20,000 PSI

Accuracy Class:

Accuracy Class.		
	±0.20%FS	±0,10%FS
Linearity	±0.15	±0.07
Repeatability	±0.03	±0.01
Hysteresis	±0.02	±0.01
Thermal Effects (%FS/°F):		
Zero		±0.025
Span	±0.07	±0.06
Proof Pressure	1.5 X	Range up to
	2	5 KPSI max.
Burst Pressure		Range up to 5 KPSI max.

Electrical Specifications

Output	8,0mV/V
Impedance	
Input	3,000 ohms nominal
Output	3,000 ohms nominal
Circuit to Case Ins	sulation
Resistance	>500 megohms @
	500 VDC
Input Voltage	5-15 VDC (10V nom.)
	±10.0% FS
Span Tolerance	±25.0% FS
Response Time	Less than 1.0 ms

Environmental Conditions

Temperature

Storage	65°F to +500°F
Operating	65°F to +500°F
Shock	100g's, .5 ms
Vibration6	g's, 10 Hz to 3 KHz
Humidityl	Hermetically sealed
Media Compatibility	All liquids and
gases compatib	le with 15-5 Ph SS,
glass, 96% alu	umina and sapphire

Physical Specifications

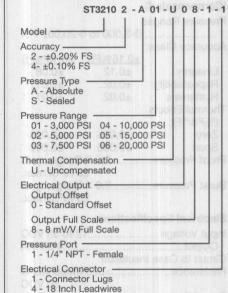
Enclosure	NEMA 4X
Weight	Less than 6 oz.

The Bourns Model 3210 Pressure
Transducer utilizes Bourns' advanced
high-pressure Sapphire Sensor
technology. The new Model ST3210
offers accuracy and reliability never
before available in a high-pressure
transducer.

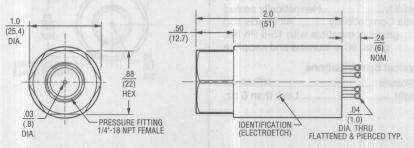
Bourns Sapphire Sensor technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages are molecularly attached to the sensing diaphragm to form a homogeneous sensor that establishes a new benchmark in long-term stability.

The Model ST3210 Sapphire
Pressure Transducer is ideally suited for use in down-hole, aerospace, oceanography and testing applications where a highly accurate, stable measurement is required. The Model ST3210 is compatible with many common corrosive fluids. Consult Bourns application specialists for complete compatibility specifications. Constructed of stainless steel, these models provide reliable long-life service and convenient installation.

HOW TO ORDER



Dimensional Drawings





HIGH PRESSURE 4-20 mA SAPPHIRE SENSOR™

- ±0.15% and ±0.10% FS accuracies
- Pressures up to 20,000 PSI
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments
- Fast response time
- Small size
- Excellent long-term stability

Model ST3230 Series

Bourns® Pressure Transmitters

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges

.....0-3,000 to 0-20,000 PSI

Accuracy Class:

	±0.15%FS	±0.10%FS
Linearity	±0.12	±0.08
Repeatability	±0.02	±0.01
Hysteresis	±0.02	±0.01
Thermal Effects		
(%FS/°F):		
	±0.006	±0.003
Span	±0.006	±0.003
Proof Pressure	1.5 X	Range up to
		5 KPSI max.
Burst Pressure	2.0 X	Range up to
	2	5 KPSI max.

Electrical Specifications

Input Voltage12 to 36 V	
Circuit to Case Insulation	IIIA
	-
Resistance>500 megohn	1S @
50	VDC
Zero Offset±0.1	mA
Span Tolerance±0.6%	
Response TimeLess than 5.0	ms)
Supply Voltage Effects±0.3% o	f FS
from 24 VDC non	ninal

Environmental Conditions

Temperature	
Compensated	40°F to +185°F
Storage	65°F to +250°F
Operating	40°F to +200°F
Shock	100g's, .5 ms
Vibration	6g's, 10 Hz to 3 KHz
Humidity	Hermetically sealed
Media Compatibility	All liquids and
gases compati	ble with 15-5 Ph SS,
glass, 96% a	lumina and sapphire

Physical Specifications

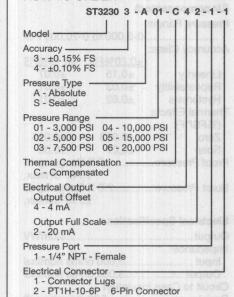
Enclosure	NEMA 4X
Weight	Less than 6 oz.

The Bourns Model 3230 High
Pressure Transmitter utilizes Bourns'
advanced Sapphire Sensor technology.
The new Model ST3230 offers
unparalleled accuracy and reliability in a
rugged 4 to 20 mA Transmitter.

Bourns Sapphire Sensor technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages are molecularly attached to the sensing diaphragm to form a homogeneous sensor that establishes a new benchmark in long-term stability.

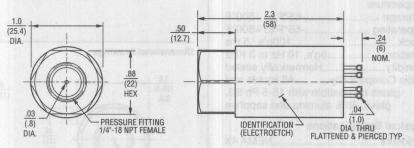
The Model ST3230 Sapphire
Pressure Transmitter is ideally suited for use in down-hole logging, and in the measurement of liquid and gas pressures where a highly accurate, stable measurement with a 4-20 mA output is needed. The Model ST3230 is compatible with many common corrosive fluids. Constructed of stainless steel, these models provide reliable long-life service and convenient installation.

HOW TO ORDER



4 - 18 Inch Leadwires

Dimensional Drawings





HIGH ACCURACY AMPLIFIED SAPPHIRE SENSOR™

- ±0.15% and ±0.10% FS accuracies
- Pressures up to 20,000 PSI
- Essentially hysteresis free operation
- Diaphragm temperature sensor output
- Operates in high shock and vibration
- Hermetically sealed for use in tough environments
- Lightweight
- Small size
- Excellent long-term stability
- 0-5 VDC Output

Model ST3240 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges

......0-3,000 to 0-20,000 PSI Accuracy Class:

Accuracy Class.		
	±0.15%FS	±0.10%FS
Linearity	±0.12	±0.08
Repeatability	±0.02	±0.01
Hysteresis	±0.02	±0.01
Thermal Effects		
(%FS/°F):		
Zero	±0.006	±0.003
Span	±0.006	±0.003
Proof Pressure	1.5 X	Range up to
		5 KPSI max.
Burst Pressure		
	2	5 KPSI max.

Electrical Specifications

	5 to 15 VDC
	5.0 VDC
	> 1,000 ohms
Circuit to Case Insul	ation
Resistance	>500 megohms @
	50 VDC
Zero Offset	±100 mV/V
Span Tolerance	±2.0% FS
Response Time	80 Hz filter
Supply Voltage Effect	cts±0.3% of FS
	rom 12 VDC nominal

Environmental Conditions

Temperature	
Compensated	40°F to +185°F
Storage	65°F to +250°F
Operating	40°F to +200°F
Shock	100g's, .5 ms
Vibration	6g's, 10 Hz to 3 KHz
Humidity	Hermetically sealed
Media Compatibility	/All liquids and
gases compa	tible with 15-5 Ph SS,
glass, 96%	alumina and sapphire

Physical Specifications

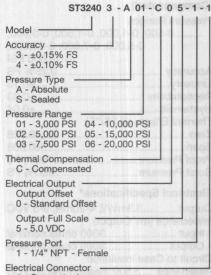
Enclosure	NEMA	4X
Weight	Less than 6 c	oz.

The Bourns Model 3240 High Pressure Transducer utilizes the Bourns advanced Sapphire Sensor technology. The new Model ST3240 offers unparalleled accuracy and reliability in a rugged 0 to 5 VDC Transducer.

Bourns Sapphire Sensor technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages are molecularly attached to the sensing diaphragm to form a homogeneous sensor that establishes a new benchmark in long term stability.

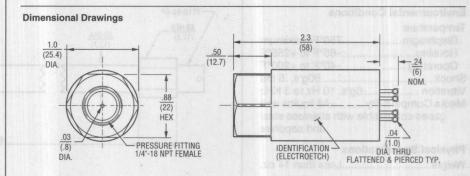
The Model ST3240 Sapphire Pressure Transducer is ideally suited for use in hydraulics, test stands, and in the measurement of liquid and gas pressures where a highly accurate, stable measurement with a voltage output is needed. The Model ST3240 is compatible with many common corrosive fluids. Constructed of stainless steel, these models provide reliable longlife service and convenient installation.

HOW TO ORDER



1 - Connector Lugs 2 - PT1H-10-6P 6-pin Connector

4 - 18 Inch Leadwires





HIGH TEMPERATURE MELT PRESSURE SAPPHIRE SENSOR™

- 0.25% FS accuracy
 - Durable sapphire diaphgragm
 - Essentially hysteresis free operation
 - Diaphragm temperature sensor output
 - Interchangeable with existing systems
 - No mercury fill fluid

- Fast response time
- Flush diaphragm
- Excellent long term stability
- Stainless steel construction
- Choice of outputs

Model ST3300 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

HOW TO ORDER

1 - 1/2"-20 UNF-2A

2 - PT1H-10-6P 6-Pin Connector

Electrical Connector

Performance Specifications (Compensated)

Pressure Ranges

......0-500, 0-1,000, 0-1,500, 0-3,000, 0-5,000, 0-7,500, 0-10,000, 0-15,000 PSI Accuracy0.25% FS Linearity±0.18

 Repeatability
 ±0.03

 Hysteresis
 ±0.04

 Thermal Effects (%FS/°F):

 Zero
 ±0.008

 Span
 ±0.008

 Proof Pressure
 150% FS

 Burst Pressure
 200% FS

Electrical Specifications*

Output......3.3mV/V, 4-20mA, 0-5 VDC Impedance (mV Output)

Resistance>500 megohms @ 50 VDC Input Voltage

 3.3mV Output
 .5-15 VDC

 4-20mA Output
 .12-36 VDC

 0-5 VDC Output
 .5-15 VDC

 Zero Offset
 .±2.0% FS

 Span Tolerance
 .±2.0% FS

 Response Time
 .Less than 5.0 ms

Environmental Conditions

Physical Specifications

WeightLess than 14 oz.

*Optional outputs 4-20mA and 0-5 VDC available external to device as shown.

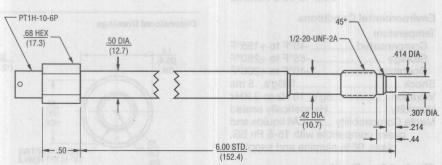
The Bourns Sapphire Sensor™ Pressure Melt technology has been developed over the last fifteen years and incorporates significant technical advances for the state-of-the-art in pressure sensing. The diaphragm's ability to withstand 750°F allows direct contact with the media and eliminates the need for intermediate fill fluids. The basic sensing diaphragm is constructed of a single crystal sapphire that is essentially free from hysteresis. This material is chemically compatible with all common acidic and alkaline materials. Sapphire is an extremely abrasion resistant material to provide long life.

The silicon epitaxial layer is grown directly on the sapphire diaphragm. The resulting high energy isolation barrier leads to stability that is unsurpassed by any other pressure sensing technology.

Literally millions of hours of use have been logged on Bourns' Sapphire Sensor™ transducers. Reliability is assured by more than forty years of Bourns' commitment to quality.

ST3300 1 - G 01 - C 0 5 - 1 - 2 Model · Accuracy Class -1 - ±0.25% FS Pressure Type G - Gage S - Sealed Pressure Range 01 - 500 PSI 05 - 5000 PSI 02 - 1000 PSI 06 - 7500 PSI 03 - 1500 PSI 07 - 10000 PSI 04 - 3000 PSI 08 - 15000 PSI Thermal Compensation C - Compensated Electrical Output 0 - Standard Offset Output Full Scale 1 - 3.3 mV/V Full Scale 2 - 4-20 mA 3 - 0-5 VDC Pressure Port

Dimensional Drawings





DOWNHOLE SAPPHIRE SENSOR™

- 0.10% and 0.05% FS accuracies
- Corrosion resistant sapphire diaphragm
- Essentially hysteresis free operation
- Up to 300°C / 500°F
- Up to 20,000 PSI
- Operates in high shock and vibration
- Hermetically sealed

- 0.75 inch diameter
- Small size
- Excellent long-term stability

Model ST3400 Series

Bourns® Pressure Transducers

For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications (Compensated)

Pressure Ranges

.....0-3,000 to 0-20,000 PSI

Accuracy Class:

±0.10%FS	±0.05%FS
±0.07	±0.035
±0.02	±0.01
±0.015	±0.01
±0.004	±0.003
±0.004	±0.003
t Pressure	250% of full
scale o	r 25,000 PSI,
which	chever is less
	±0.07 ±0.02 ±0.015 ±0.004 ±0.004 t Pressure scale of

.....5,000 PSI

Instrument Case Burst Pressure

Electrical Specifications

5.0mV/V
3,000 ohms nominal
3,000 ohms nominal
ation
>500 megohms @
500 VDC
5-15 VDC (10V nom.)
±0.1 mV/V
±2.0% FS
Less than 1.0 ms

Environmental Conditions

Temperature* Compensated-65°F to +255°F Storage-65°F to +255°F Operating-65°F to +255°F Shock......100g's, .5 ms Vibration6g's, 10 Hz to 3 KHz Humidity......Hermetically sealed Media Compatibility......All liquids and gases compatible with Inconel 625, glass, 96% alumina and sapphire

Physical Specifications

Enclosure		.NEM	IA	4X
Weight	.Less	than	4	oz.

*Contact factory for devices above 125°C. Available up to 300°C.

The Bourns Model ST3400 Sapphire Sensor has been specifically developed for oil exploration and geophysical measurement where high pressure, high temperature, corrosive gas and shock conditions are present.

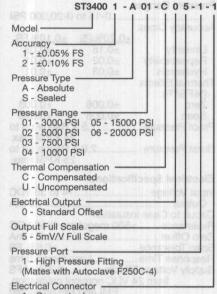
All surfaces exposed to the hostile environment are made of high nickel alloys and the single crystal sapphire diaphragm itself is impervious to virtually all media.

As with all Bourns Sapphire Sensors. the output has almost imperceptibly low hysteresis over the full operating range and over the life of the sensor.

Applications include deep well instruments, sub-ocean floor, geothermal and geophysical survey and real time monitoring of subterranean phenomena.

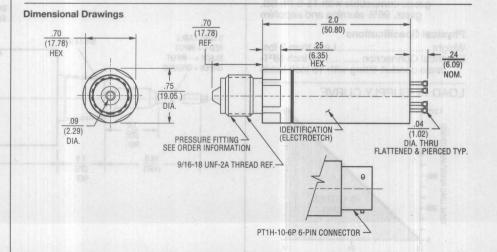
CAUTION! This sensor is specifically for use in downhole applications where the ambient and sensed pressure are similar. For high-pressure surface applications, see our ST3200 Series.

HOW TO ORDER



1 - Connector Lugs 2 - PT1H-10-6P 6-pin Connector

4 - 18 Inch Leadwires





EXPLOSION PROOF SAPPHIRE SENSOR™

- "Explosion proof" for hazardous applications
- Two-wire signal transmission
- Long-term stability
- Temperature stability
- EMI and RFI suppression
- Reverse polarity protection

- FM/CSA approval*
- Lightning protection
- Sapphire pressure sensor for high repeatability and accuracy
- Rugged stainless steel construction

Model ST5020 Series

Bourns® Pressure Transmitter

In the US and Canada For Immediate Applications Assistance, Call: 1-800-X-DUCERS

Performance Specifications

Pressure Ranges	ST3400 1 - 1	
FILE TILL	0-15 to	0-20,000 PSI
Accuracy Class:	0 10 10	0 20,000 1 01
Accuracy Class.	0.000/50	0.400/.50
	±0.20%FS	±0,10%FS
Linearity	±0.16	±0.08
Repeatability	±0.02	±0.01
Hysteresis	±0.03	±0.01
Thermal Effects	10.00	egyl enuaders
(%FS/°F):		bolone P
Zero	±0.006	±0.003
Span	±0.006	±0.003
Proof Pressure	1.5 >	Range up to
1 1 1 10 10 1		25 KPSI max.
Burst Pressure		Range up to
buist Flessure		
		25 KPSI max.

Electrical Specifications

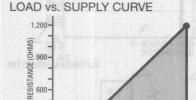
Input Voltage14 to 36 VDC
Output4-20 mA
Circuit to Case Insulation
Resistance>500 megohms @ 50 VDC
Zero Offset±0.1 mA
Span Tolerance±0.6% FS
Response TimeLess than 5.0 ms
Supply Voltage Effects±0.3% of FS
from 24 VDC nominal calibration,
EMI and RFI protected

Environmental Conditions

Temperature	
Compensated	40°F to +185°F
Storage	65°F to +255°F
	40°F to +200°F
	100g's, .5 ms
Vibration	.6g's, 10 Hz to 3 KHz
Humidity	Hermetically sealed
Media Compatibility	All liquids and
gases compat	ible with 15-5 Ph SS,
glass, 96%	alumina and sapphire

Physical Specifications

Weight	Less than 2 lbs.
Electrical Connection	3/4 inch NPT-
male conduit fittir	ng with 18 inch leads



POWER SUPPLY VOLTAGE (VDC) **OPERATING LOAD VERSUS SUPPLY VOLTAGE**

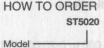
OPERATING

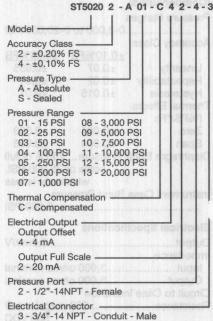
RANGE

The Bourns Model 5020 Industrial Pressure Transmitter for hazardous applications utilizes the Bourns Sapphire Sensor technology. The new Model 5020 Sapphire Pressure Transmitter offers accurate, stable, and dependable transmitter performance in a wide variety of standard ranges.

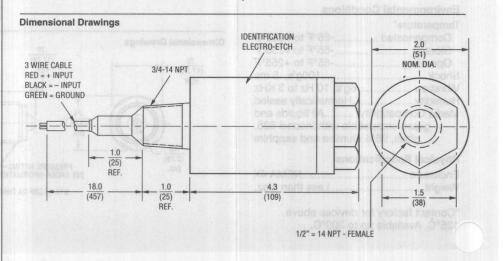
The Bourns Sapphire Sensor technology sets new standards in strain gage pressure measurement precision. The Sapphire Sensor utilizes nature's nearperfect, single-crystal sapphire as the pressure sensing diaphragm which virtually eliminates hysteresis. The epitaxially grown strain gages are molecularly attached to the sensing diaphragm to form a homogeneous sensor that establishes a new benchmark in long-term stability.

The Model ST5020 Sapphire Pressure Transmitter is ideally suited for use in down-hole logging, and in the measurement of liquid and gas pressures where an explosion proof, highly accurate, stable measurement with a 4-20 mA output is needed. Constructed of stainless steel, these models provide reliable long-life service and convenient installation.





*FM/CSA approval recertification pending.



LOAD

Turns-Counting Dials

I. Product Selection Guide321

m For use with precision potentiometers or other rotating devices up to

m No backash - mounted directly to potentiometer shaft

II. Dials

22mm, 0-15 Turn Dials	328, 329, 330	0
25mm, 0-30 Turn Dials	32	7
25mm, 0-10 Turn Dials	324	4
27mm, 0-10 Turn Dials	32:	2
28mm, 0-10 Turn Dials	32:	2
28mm, 0-10 Turn Dials	32:32	3
46mm, 0-20 Turn Dials	325, 326	6



PRODUCT SELECTION GUIDE

Model No.	Turns	Approximate Package Diameter	Approximate Package Depth	Page No.
CT-23	0-10	27mm	31.5mm	322
CT-26	0-10	28mm	31.5mm	322
MD-50	0-10	28mm	33mm	323
CT-50	ne paga ismetri 0-10 lav sevas le	5 pnisma00 25mm	33.9mm	324
CT-46	0-20	46mm	25.4mm	325
H-46	.mu. s To 000-20 15 W sprillon	46mm	24mm	326
H-490	0-30	25mm	23.1mm	327
H-506	25 TO IsboM & 0-15 and 02 hear	22mm	25.0mm	328
H-507-6	0-15	22mm	25.0mm	329
H-22	.nagreinuo 0-15) vasiuose b	as validade 22mm	25.0mm	330

POT/DIAL SELECTION GUIDE

				3400S-1	3500S-2	3501H-1	3540S-1 3541H-1 3543S-1 3545S-1	3590		Fre (2097)
	Diameter (Inches)	Brake	Dial					1/4" Dia.	6mm Dia.	3700S-1 3701H-1
А	7/8	Yes	H-507-6A	May X	X	X	X	X	f ninkertoal	es meson.
Α	TOTAL PARTY	No	H-491-1	DE PRESONA	40.000	mananit ther	a salar managan	n orbitalism	officianies is	X
Α	les 1	No	H-491-2	no adt old		to fuobres is	brent lo trum	evorn pric	uso iuorah	werrelea
A	nic eft revo	No	H-491-3	X	X	X	X	X	AND STREET	frounding
A	OUT BUILDING THE	Yes	H-492-1	The digl. T						X
Α	1	Yes	H-492-2	AND DESCRIPTION OF THE PARTY OF				- SY 01		
Α	1	Yes	H-492-3	X	X	X	X	X		211
A	1	No	H-493-1	Value of the same				T) No.		X
Α	. 1	No	H-493-2						E	
Α	1	No	H-493-3	X	X	X	X	X		
А	1	Yes	H-494-1				Hardwick and S	1.8841		X
A	1	Yes	H-494-2			1000				
А	1	Yes	H-494-3	X	X	X	X	X		
D	1.07	Yes	CT-23-6A	X	Х	X	X	X		TO STATE OF THE PARTY OF THE PA
D	1.21	Yes	CT-26-6A	X	X	X	X	X		19
A	.898	Yes	H-506-1/4	X	X	X	X	X		10.0
A	7/8"	Yes	H-507-6M	1000	00.1 - 60.00 F	BA MARKAN	100 F 100		X	
Α	1.79	Yes	CT-46-6A	X	X	X	X	X	81444	
D	1 1	Yes	CT-50-6AH	X	X	X	X	X		
Α	1.81	Yes	H-46-6A	X	X	X	X	X		
А	7/8"	Yes	H-22-6A	X	X	X	X	X	4.41	HE WAY
D	1.21	Yes	MD-50-1/4	X	X	X	X	X		TO SECURITION



27MM AND 28MM DIAMETER / 0-10 TURNS

- No backlash mounted directly to potentiometer shaft
- For use with precision potentiometers or other rotating devices up to
- High force, positive brake

Models CT-23/CT-26

Bourns® Turns-Counting Dials

Mechanical	and	Physical	Charac	teristics

Number of Turns	
Readability	
Accepts Shaft Diameter	
Locking Brake	Positive, friction

Shaft and Bushing Requirements

Shaft Extension Beyond Face of Locator Plate	11.05mm minimum
of Court, the last case case should be the first that the second section of the court of the court of the court	16.25mm maximum
Bushing Extension Beyond Face of Locator Plate	4.00mm maximum

FEATURES

- For use with precision potentiometers or other rotating devices up to 10 turns
- Simplified mounting
- High quality, rugged construction throughout No backlash mounted directly to potentiometer shaft
- White digits on black counter wheels for maximum readability
- High force, positive brake

Bourns® Model CT-23, front of panel mounting, digital turns-counting dial saves valuable internal space. Highly accurate, it will enhance the man/machine interface of any control panel. Easy to read white on black numerals provide excellent legibility and accurate readings within 1/500 of a turn.

Bourns® Model CT-26 recessed mounting digital turns-counting dial, counterpart to the Bourns Model CT-23, provides a lower panel profile. The design simplifies installation requiring only one panel hole. The CT-26 maintains the same high level of symmetry, legibility and accuracy of its counterpart.

CT-23 MOUNTING INSTRUCTIONS

- Drill or punch panel. See suggested hole pattern below.
- Insert potentiometer in panel
- 3. Position locator plate against panel and secure with hex nut making sure that anti-rotation tang is in the small hole.
- Turn the potentiometer shaft counterclockwise to obtain minimum resistance or voltage ratio (not necessarily at the end of travel).
- Loosen setscrew in knob with allen wrench. Set the dial readout . to "000." $\,$
- Slip the dial carefully over the potentiometer shaft. Tighten the setscrew without causing movement of the dial readout or potentiometer shaft.

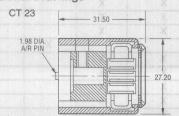
10.31 MIN

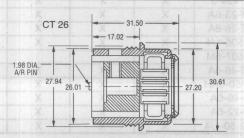
CT-26 MOUNTING INSTRUCTIONS

- Drill or punch panel. See suggested hole pattern below.
- Insert turns-counting dial in panel cutout and secure with mounting nut.
- Secure locator plate to potentiometer bushing using two hex nuts.
- Turn the potentiometer shaft counterclockwise to obtain minimum resistance or voltage ratio (not necessarily at the end of travel).
- Loosen setscrew in turns-counting dial with allen wrench. Set the dial readout to "000."
- Slip the potentiometer shaft into the turns-counting dial, insuring that the notch in the locator plate is over the pin at the rear of the dial. Tighten the setscrew without causing movement of the dial readout or potentiometer shaft.



Dimensional Drawings





Shaft Diameter

Part Number	Accepts Shaft Diameter
CT-23-6A	1/4" (6.35mm)
CT-26-6A	1/4" (6.35mm)

Specifications are subject to change without notice.



28MM DIAMETER / 0-10 TURNS

- For use with precision potentiometers up to 10 turns
- Recessed mounting provides lower panel profile
- No backlash
- Excellent price/performance value

Model MD-50 Series

Bourns® Turns-Counting Dials

Mechanical and Physical Characteristics

Number of Turns	10
Readability	1/5000
Torque With Brake Engaged	5 .0 Ncm min.
Weight	34 grams
Markings	White figures on black background

Shaft and Bushing Requirements

onare and Daorning Hodan ornario	
Shaft Extension Beyond Locator Plate	
munisem (mm3.87) ini (78.5mm) maseraum	16.5mm (0.65") maximum
Bushing Extension Beyond Locator Plate	4.1mm (0.16") maximum

FEATURES

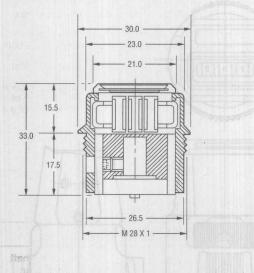
- For use with precision potentiometers or other rotating devices up to 10 turns
- · Excellent legibility white marking on black background
- High quality, rugged construction

- Dial will not rotate when brake is applied
- Standard models available for 6.35mm (1/4") diameter shafts
- Simplified mounting

MD-50 MOUNTING INSTRUCTIONS

- 1. Drill or punch panel as illustrated in hole pattern.
- Insert turns-counting dial in panel cutout and secure with mounting nut.
- 3. Secure locator plate to potentiometer bushing using 2 hex-nuts.
- Turn the potentiometer shaft counter-clockwise to obtain minimum resistance or voltage ratio (not necessarily at the end of travel).
- Loosen setscrew in turns-counting dial. Set the dial readout to "000".
- 6. Slip the potentiometer shaft into the turns-counting dial, insuring that the notch in the locator plate is over the pin at the rear of the dial. Tighten the setscrew without causing movement of the dial readout or potentiometer shaft.

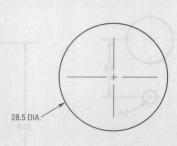
Dimensional Drawings

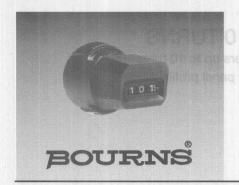


Shaft Diameter

Part Number	Accepts Shaft Diameter
MD-50-1/4*	1/4" (6.35mm)

*Preferred Part Number





22MM DIAMETER / 0-10 TURNS

- Simplified mounting
- Compact size

Model CT-50

Bourns® Turns-Counting Dials

Mechanical and Physical Characteristics

Number of Turns	0 to 10
Readability	
Weight	
Markings	White on black background
Accepts Shaft Diameter	See below

Shaft and Bushing Requirements

0.73 in. (18.5mm) maximum

FEATURES

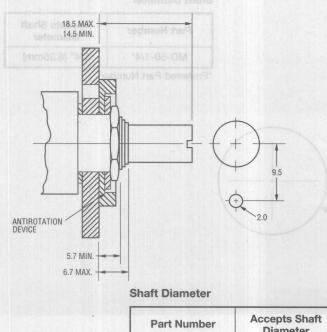
- For use with precision potentiometers or other rotating devices up to 10 turns.
- Excellent legibility white marking on black background.
- High quality, rugged construction.
- Two set screws.
- Dial will not rotate when brake is applied.

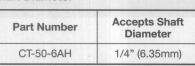
 Compact Requires only 1" (25.4mm) diameter panel space.
- Standard models available for 6mm and 1/4" (6.35mm) diameter . shafts.

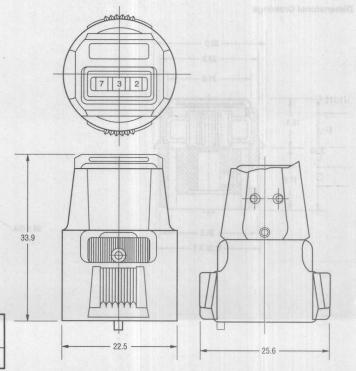
MOUNTING INSTRUCTIONS

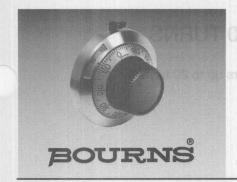
- 1. Drill anti-rotation hole of 0.079" (2mm), 0.374" (9.50mm) below centerline of potentiometer (see illustration).
- Insert potentiometer in panel.
- Install anti-rotation device supplied with dial. Use standard lockwasher and mounting nut supplied with potentiometer.
- Turn the potentiometer shaft counter-clockwise to minimum resistance or voltage ratio. This is not necessarily identical with the mechanical stop.
- Set the dial at zero and slip it carefully over the potentiometer shaft. Tighten the set screws without causing movement of the dial readout or potentiometer shaft.

Dimensional Drawings









46MM DIAMETER / 0-20 TURNS

- Large package size
- For use with precision potentiometers up to 20 turns
- Excellent readability
- Precision feel no backlash

Model CT-46

Bourns® Turns-Counting Dials

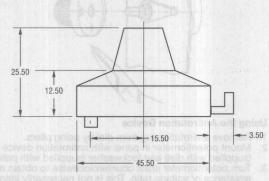
Mechanical and Physical Characteristics

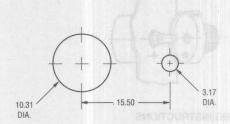
Number of Turns	0 to 20
Readability	
Weight	55 grams
Markings	
Accepts Shaft Diameter	See below
Locking Brake	Yes

Shaft and Bushing Requirements

Shaft Extension Beyond Panel	
mumwmm (mm) 23.5 mm) maximum	0.925 in. (23.5mm) maximum
Bushing Extension Beyond Panel	

Dimensional Drawing (Governing dimensions in inches)





PANEL LAYOUT

Part Number	Accepts Shaft Diameter
CT-46-6A	1/4" (6.35mm)
CT-46-6M	6mm





46MM DIAMETER / 0-20 TURNS

- Large package size
- For use with precision potentiometers up to 20 turns
- Excellent readability
- Precision feel no backlash
- Cast housing

Model H-46

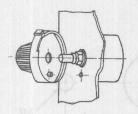
Bourns® Turns-Counting Dials

Mechanical and Physical Characteristics

Number of Turns	0 to 20
Readability	
Weight All	73 grams
Markings	White on black background
Accepts Shaft Diameter	
Locking Brake	Yes

Shaft and Bushing Requirements

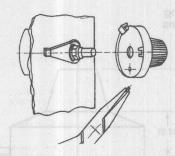
Shaft Extension Beyond Panel	
0.925 in. (23.5mm) maximum	0.925 in. (23.5mm) maximum
Bushing Extension Beyond Panel	



H-46 MOUNTING INSTRUCTIONS

Using the existing Antirotation Lug

- 1. Drill 0.125 (3.2mm) diameter antirotation pin hole on vertical centerline 0.562 (14.3mm) below center of potentiometer mounting
- Mount potentiometer shaft counterclockwise to obtain minimum resistance or voltage ratio. This is not necessarily identical with the mechanical stop.
- Loosen set screws in knob of dial. Set dial to "0.0" reading.
- While holding outer ring of dial, position unit lightly against panel. Tighten knob set screws to potentiometer shaft.

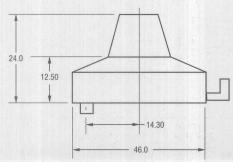


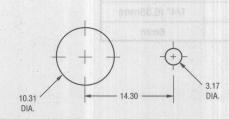
Using the Antirotation Device

- Remove antirotation lug from dial by using pliers.
- Mount potentiometer in panel with antirotation device nut (supplied with dial) and lockwasher (supplied with potentiometer). Turn potentiometer shaft counterclockwise to obtain minimum resistance or voltage ratio. This is not necessarily identical with
- Loosen set screws in knob of dial. Set dial to "0.0" reading.
 While holding outer ring of dial, position unit lightly against panel.
 Tighten knob set screws to potentiometer shaft.

Dimensional Drawing (Governing dimensions

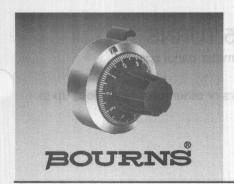
in inches)





PANEL LAYOUT

Part Number	Accepts Shaft Diameter
H-46-6A	1/4" (6.35mm)



25MM DIAMETER / 0-30 TURNS

- No backlash mounted directly to potentiometer shaft
- For use with precision potentiometers or other rotating devices up to
- Compact size requires only 25.4mm diameter panel space
- Available with or without brake

Model H-490

Bourns® Turns-Counting Dials

Mechanical and Physical Characteristics

Number of Turns	0 to 30
Dial Divisions	100 per turn
Readability - Over 10 Turns	1 part in 1000
Torque With Brake Engaged	5 oz-in. minimum
Weight	
Markings	White on black background
Set Screws	2 screws 120° apart

Environmental Characteristics

Operating Temperature Range15°C to +85°C	
Mechanical Life	
Set Screw Tightening Torque	

Shart and bushing Requirements	
Shaft Extension Beyond Panel	15.75mm minimum
경우가 있는 보게 없다면 있었습니다. 그리고 있는데 수 있는데 사람들이 사용하는데 보는 사람들이 되었다면 하는데 살아 하는데 되었다.	21.21mm maximum

Bushing Extension Beyond Panel......9.02mm maximum

FEATURES

- For use with precision potentiometers or other rotating devices up to 30 turns
- Readability 1 part in 1000 for ten turns
- Simplified mounting no special panel holes required Compact requires only 25.4mm diameter panel space
- No backlash mounted directly to potentiometer shaft Standard models available for 2.38mm, 3.18mm and 6.35mm
- Excellent legibility white marking on black background
- Two set screws standard on all models Available with or without brake

H-490 MOUNTING INSTRUCTIONS

- Discard standard mounting nut and lockwasher supplied with the potentiometer; they will not be used.
- Insert potentiometer; they will not be used.

 Insert potentiometer in panel.

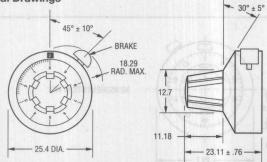
 Using parts supplied with dial, position anti-rotation washer against panel. Tangs of washer should stick out from panel.

 Install mounting nut supplied with dial. Be sure:

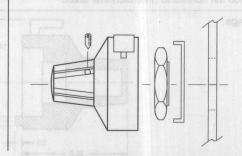
 a. Shoulder on nut engages hold of anti-rotation washer.

 b. Tangs of anti-rotation washer are aligned vertically. This
- - positions the turns-counting window properly.
- 5. Turn potentiometer shaft counterclockwise to minimum resistance or voltage ratio. This is not necessarily at the end of
- Loosen set screw in knob of dial assembly. Set dial to "0.00"
- reading. Slip dial assembly over end of potentiometer shaft. Holding outer ring of dial assembly, engage locating tangs on anti-rotation washer in notches on dial assembly.
- While holding outer ring, position unit lightly against panel.
 Uniformly tighten knob set screws to potentiometer shaft with furnished hex wrench.

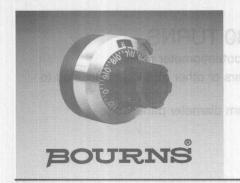
Dimensional Drawings



Part Number	Fits Shaft Diameter	Fits Bushing Size	Brake	Body Finish
H-491-1	2.38mm	6.35mm-32UNEF-2A	No	Clear
H-492-1	2.38mm	6.35mm-32UNEF-2A	Yes	Clear
H-493-1	2.38mm	6.35mm-32UNEF-2A	No	Black
H-494-1	2.38mm	6.35mm-32UNEF-2A	Yes	Black
H-491-2	3.18mm	6.35mm-32UNEF-2A	No	Clear
H-492-2	3.18mm	6.35mm-32UNEF-2A	Yes	Clear



Part Number	Fits Shaft Diameter	Fits Bushing Size	Brake	Body Finish
H-493-2 H-494-2 H-491-3 H-492-3 H-493-3 H-494-3	3.18mm 3.18mm 6.35mm 6.35mm 6.35mm 6.35mm	6.35mm-32UNEF-2A 6.35mm-32UNEF-2A 9.53mm-32UNEF-2A 9.53mm-32UNEF-2A 9.53mm-32UNEF-2A	No Yes No Yes No Yes	Black Black Clear Clear Black Black



22MM DIAMETER / 0-15 TURNS

- Compact, requires only 22.7mm diameter panel space
- No backlash
- For use with precision potentiometers or other rotating devices up to 15 turns Compact size - requi
- Plastic shaft

Model H-506

Bourns® Turns-Counting Dials

Mechanical and Physical Characteristics

Number of Turns	0 to 15
Dial Divisions	50 per turn
Readability - Over 10 Turns	2 parts in 1000
Torque With Brake Engaged	7.0 oz-in. (5.0 Ncm) minimum
Weight	7 grams
Markings	White on black background
Set Screws	2 screws 120° apart

Shaft and Bushing Requirements

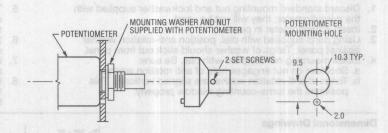
Shaft Extension Beyond Panel..... ...0.6890 in. minimum (17.5 mm) 0.8858 in. maximum (22.5 mm)

FEATURES

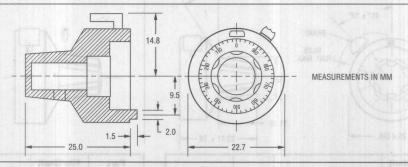
- For use with precision potentiometers or other rotating devices up to 15 turns
- Excellent legibility white marking on black background
- High quality, rugged construction
- Two set screws
- No backlash
- High force, positive brake
- Compact requires only .9" (22,86mm) diameter panel space Standard models to fit 1/4" and 6mm diameter shafts

H-506 MOUNTING INSTRUCTIONS

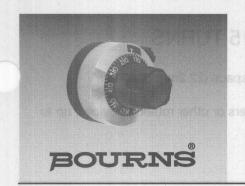
- 1. Drill .0787 (2.0) diameter anti-rotation pin hole on vertical centerline, .375 (9.5mm) below center of potentiometer mounting hole.
- Mount potentiometer in panel with nut and lockwasher supplied with the potentiometer.
- Turn potentiometer shaft counterclockwise to obtain minimum resistance or voltage ratio. This is not necessarily identical with mechanical stop.
- Loosen set screws in knob of dial. Set dial to "0.0" reading.
- While holding outer ring of dial, position unit lightly against panel. Tighten knob set screws to potentiometer shaft.



Dimensional Drawings



Part Number	Accepts Shaft Diameter
H-506-1/4	1/4" (6.35mm)



22MM DIAMETER / 0-15 TURNS

- No backlash
- Compact requires minimal panel space (22.2mm diameter requirement)
- For use with precision potentiometers or other rotating devices, up to 15 turns
- Metal shaft

Model H-507-6

Bourns® Turns-Counting Dials

Mechanical and Physical Characteristics

Number of Turns	
Dial Divisions	50 per turn
Readability - Over 10 Turns	2 parts in 1000
Torque With Brake Engaged	5 oz-in. (350 cm. gr.) minimum
Weight	7 grams
Markings	
Mechanical Life	10,000 cycles
Set Screws	1 included

Shaft and Bushing Requirements	Shall and Bushing Requirements
Shaft Extension Beyond Panel	
. (ran 2.2.2 muraxim maximum (22.2 mm)	0.8504 in. maximum (21.6 mm)
Bushing Extension Beyond Panel	
Shaft Diameter	1/4" (6.35 mm)

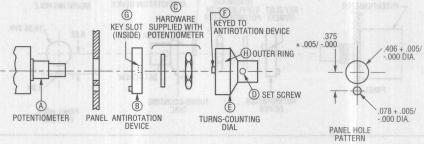
FEATURES

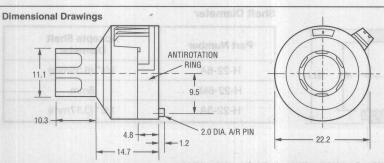
- For use with precision potentiometers or other rotating devices up to 15 turns
- Excellent legibility white marking on black background
- High quality, rugged construction, aluminum housing, metal-to-metal setscrew threads
- No backlash mounted directly to potentiometer shaft
- Compact requires only 7/8" (22.35) diameter panel space
- High force, positive brake

H-507-6 MOUNTING INSTRUCTIONS

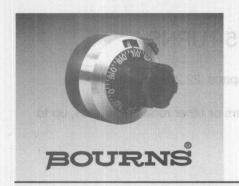
- Insert potentiometer A in panel.
- Install anti-rotation device ^B using hardware ^C supplied with potentiometer.
- Turn potentiometer shaft counterclockwise to minimum
- resistance or voltage ratio.

 Loosen set screw ^D in knob of turns-counting dial ^E using allen wrench. Set dial to "0.0."
- 5. Mount dial on potentiometer shaft and position against anti-rotation device. Care must be exercised to insure dial key f
- is inserted in anti-rotation device slot °. While holding outer ring " of turns-counting dial, tighten set screw ° to potentiometer shaft.





Part Number	Accepts Shaft Diameter
H-507-6A	1/4" (6.35mm)
H-507-6M	6mm
H-507-B6A	1/4" (6.35mm) Plastic Shaft



22MM DIAMETER / 0-15 TURNS

- No backlash
- Compact requires minimal panel space (22.2mm diameter requirement)
- For use with precision potentiometers or other rotating devices, up to 15 turns
- Metal shaft

Model H-22

Bourns® Turns-Counting Dials

Mechanical and Physical Characteristics

Number of Turns	0 to 15
Dial Divisions	50 per turn
Readability - Over 10 Turns	
Torque With Brake Engaged	
Weight	15 grams
Markings	Black on chrome background
Mechanical Life	
Set Screws	

Shaft and Bushing Requirements

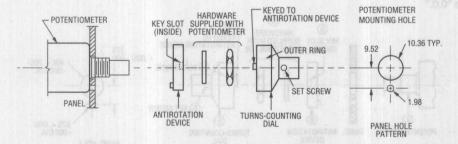
Shaft Extension Beyond Panel	
(mm 8.19) murnixam in 408.0	0.875 in. maximum (22.2 mm)
Bushing Extension Beyond Panel	
Shaft Diameter	

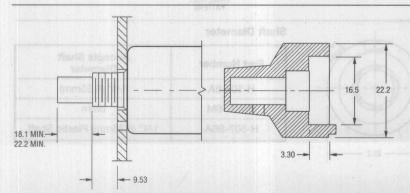
FEATURES

- For use with precision potentiometers or other rotating devices up to 15 turns
- Excellent legibility black marking on chrome background High quality, rugged construction, hardchrome housing, metal-to-metal setscrew threads
- No backlash mounted directly to potentiometer shaft Compact requires only 7/8" (22.2) diameter panel space
- High force, positive brake
- White numbers on black background on request

H-22 MOUNTING INSTRUCTIONS

- 1. Insert potentiometer in panel.
- Install anti-rotation device using hardware supplied with potentiometer.
- Turn potentiometer shaft counterclockwise to minimum resistance or voltage ratio.
- 4. Set the Model H-22 dial to "0.0" and brake on.
- Insert the Model H-22 dial on the potentiometer shaft lightly against the panel.
- Tighten set screw to potentiometer shaft

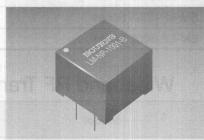




Part Number	Accepts Shaft Diameter
H-22-6A	1/4" (6.35mm)
H-22-6M	6mm
H-22-3A	1/8" (3.17mm)

Inductive Components and principle of the components and principle of the components and principle of the components are components and components are components are components and components are components are

	1.	Product Selection Guide332
	11.	Line Matching Models
		LM-NP/LP-1000 Series333
		LM-9000 Series
		SM-LP-5001 Series
		SM-LP-5002 Series
- 000		SIVI-LI -3002 Series
	Ш	Wideband RF Transformers
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		nrz/nro/nr4 Selles
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	IV.	
		0604 & 0303 Series341
	1/	Inductors
	V.	
		SMT Chip Inductors CM 45 Series351
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		Lab Kits356
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		SMT Power Inductors
		SDR 0805 Series357
		SDR 1006 Series358
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		RL 0608 Series
		RL 0812 Series362
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		RLB 0912 Series367
360		RLB 0914 Series367
		RLB 1314 Series367
		Shielded Inductors
		FSR 1013 Series372





PRODUCT SELECTION GUIDE INDUCTIVE COMPONENTS Line Matching Models

Model	SMT	Leaded	Sealed	Open	Page No.
LM-NP/LP-1000 Series		•	L MOGELS	LINS WATCHIS	333
LM-9000 Series	Ard	•	Sand	conoctat	335
SM-LP-5001 Series	788		01 Serfes	1 SM-LP-50	337
SM-LP-5002 Series	800		102 Ser+as	SM-LP-SI	338

Wideband RF Transformers

Model	SMT	Leaded	Sealed	Open	Page No.
RF2 Series	1 -8		303 Series	0604 & 0.	339
RF3 Series	•	•			339
RF4 Series	•		eno outont o	SMT Chir	339

Balun Transformers

Model	SMT	Leaded	Sealed	Open	Page No.
0604 Sizes		*************	805 Series	FOR .	341
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Inductors

Model	SMT	Leaded	Sealed	Open	Page No.
CM 45 Series	•		•		351
CM 32 Series	•		int.Incientors	High Curts	351
SDR 0805 Series	¥08•		2 Series	• FLB 07	357
SDR 1006 Series	00		IZ-Senes	BUBUR.	358
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RL 0608 Series		•	•		362
RL 0812 Series			a•oraubi	Shielded in	362
RL 1014 Series	372		43 Sajes	FSR 10	362
RLB 0712 Series		•	•		367
RLB 0912 Series		• -	•		367
RLB 0914 Series		•	•		367
RLB 1314 Series		•	•		367
FSR 1013 Series		•			372

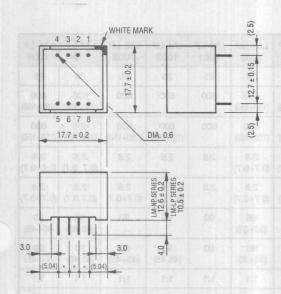


TELEPHONE LINE MATCHING TRANSFORMERS

- Fully encapsulated
- Low profile
- High dielectric strength
- Ten models available
- Ex stock

LM-NP/-LP 1000 Series

Bourns® Line Matching Models



Note

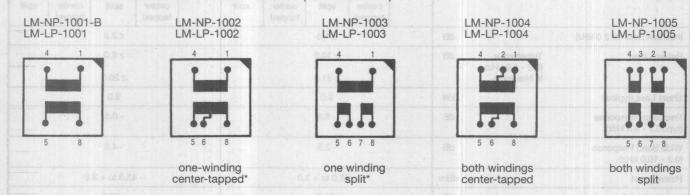
The LM-NP/-LP-1000 Series Line Matching Transformers meet the return loss specifications of BS 6305.

It is important, however, to use the circuit recommended by BS 6305 for return loss measurements.

The LM-NP-1000 Series are EN 41003 approved.

Scale = 1:1 Dimensions in mm.

PIN ASSIGNMENT AND WINDING CONFIGURATIONS (BOTTOM VIEW)



Due to the unique design and the most advanced manufacturing techniques the 2 coils are fully identical, meaning there is no real primary nor secondary winding. Depending on the application, the transformers can be used either way.

TELEPHONE LINE MATCHING TRÂNSFORMERS

m Ten models available

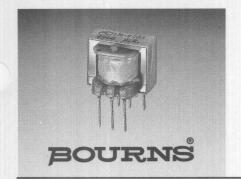
- Competitively priced
- BS 415 approved
- Weight 6g

LM-NP/-LP 1000 Series

Bourns® Line Matching Models

PART NUMBERS AND SPECIFICATIONS

Parameters	allonaji bean e	Unit	LM-NP 1001	LM-NP 1002	LM-NP 1003	LM-NP 1004	LM-NP 1005	LM-LP 1001	LM-LP 1002	LM-LP 1003	LM-LP 1004	LM-LP 1005
Ref. Temperature Data	of sevewed tos	°C	25	25	25	- 25	25	25	25	25	25	25
Impedance (min./at 1.0 kHz)	Primary	Ω	600	600	600	600 (150, 150)	600 (150+150)	600	600	600	600 (150, 150)	600 (150+150)
EN 41003 approved.	Secondary	Ω	600	600 (150,150)	600 (150+150)	600 (150,150)	600 (150+150)	600	600 (150,150)	600 (150+150)	600 (150,150)	600 (150+150
Inductance (min./at 0.2 kHz)	Primary	H	2.8	2.8	2.8	2.8 (0.7, 0.7)	2.8 (0.7+0.7)	2.8	2.8	2.8	2.8 (0.7, 0.7)	2.8 (0.7+0.7
	Secondary	Н	2.8	2.8 (0.7,0.7)	2.8 (0.7+0.7)	2.8 (0.7,0.7)	2.8 (0.7+0.7)	2.8	2.8 (0.7,0.7)	2.8 (0.7+0.7)	2.8 (0.7,0.7)	2.8 (0.7+0.7
DC-Resistance (typical/±10%)	Primary	Ω	66	66	66	66 (33,33)	66 (33+33)	90	90	.90	90 (45,45)	90 45+45)
	Secondary	Ω	66	66 (33,33)	66 (33+33)	66 (33,33)	66 (33+33)	90	90 (45,45)	90 (45+45)	90 (45,45)	90 45+45)
Turns Ratio (≤ ±2%)		_	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1
Winding Configurations				one winding center tapped	one winding split	both windings center tapped	both windings split		one winding center tapped	one winding split	both windings center tapped	both windings split
Insertion Loss (at 2.0 kHz)	LM-NP-1004 LM-LP-1004	dB		ЕПОТО	THUS J	tapped	002	M-NP-1	тарреа	≤ 2.0	tapped	J-MJ
Return Loss	Transformer (0.2 - 4.0 kHz) In Networks	dB			≥ 10.0 ≥ 21.0		T.	1		≥ 8.0 ≥ 20.0		NA WAR
Shunt Loss (typical)		kW			9.0					9.0		
Frequency Response (typ./0.2 - 3.5 kHz)	155	dB		17	- 0.3			12		- 0.5		
Wide Band Response (0.2 - 10.0 kHz)		dB		1 t t	- 2.5					- 4.5		
Power Level	enter-tapped	dBm		THE	45.0 to + 3	3.0	"beo"	enter-tal	0 -	43.0 to + 3	.0	
Longitudinal Balance (0.3 - 5.0 kHz)	tess on al shartt gnines	dB	fully ident	ero pilos S	-80.0	ndbet grib	Jiophuner.	advanced	teom odt	- 70.0	i duginir s	Due to In
Distortion (0 dB/at 1.0 kHz)		%			≤ 0.1	been ed	живеть сап	denest edi	,noissalig	≤ 0.25	Deparule	Lupulm
Leakage Induction (typical)		mH			14.0		11-12			14.0		
Dielectric Strength (P/S)		kVDC			6.5					6.5		
Temperature Range	Operation	°C			-10 to +60)				-10 to +60		
	Storage	°C			-20 to +70					-20 to +70		
Specifications Met		BS	6204: Cor 6301: Isol 6305: Ret	ation						Rec. T/CD (Sept. 1982		



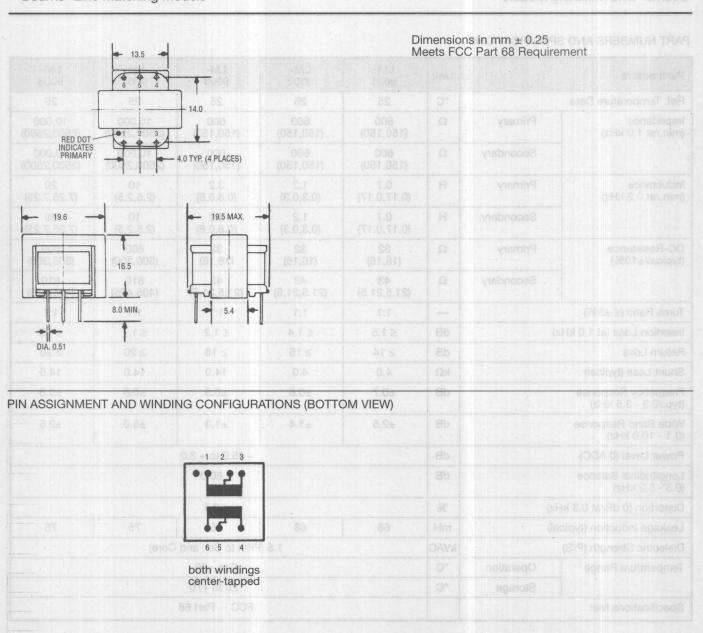
TELEPHONE LINE MATCHING TRANSFORMERS

- Wideband response
- Low insertion loss
- Five models
- Ex stock
- Competitively priced

■ Weight - 13g

LM-9000 Series

Bourns® Line Matching Models



TELEPHONE LINE MATCHING TRANSFORMERS

w Wideband response

M Competitively priced

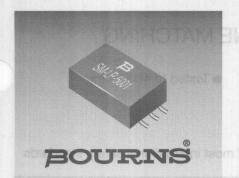
LM-9000 Series

M Weight - 13g

Bourns® Line Matching Models

PART NUMBERS AND SPECIFICATIONS

Parameters		Unit	LM- 9001	LM- 9002	LM- 9003	LM- 9004	LM- 9005	
Ref. Temperature Data		°C	25	25	25	25	25	
Impedance (min./at 1.0 kHz)	Primary	Ω	600 (150,150)	600 (150,150)	600 (150,150)	10,000 (2500,2500)	10,000 (2500,2500)	
	Secondary	Ω	600 (150,150)	600 (150,150)	600 (150,150)	10,000 (2500,2500)	10,000 (2500,2500)	
Inductance (min./at 0.2 kHz)	Primary	Н	0.7 (0.17,0.17)	1.2 (0.3,0.3)	3.2 (0.8,0.8)	10 (2.5,2.5)	29 (7.25,7.25)	
	Secondary	Н	0.7 (0.17,0.17)	1.2 (0.3,0.3)	3.2 (0.8,0.8)	10 (2.5,2.5)	29 (7.25,7.25)	
DC-Resistance (typical/±10%)	Primary	Ω	32 (16,16)	32 (16,16)	32 (16,16)	600 (300,300)	600 (300,300)	
	Secondary	Ω	43 (21.5,21.5)	43 (21.5,21.5)	43 (21.5,21.5)	810 (405,405)	810 (405,405)	
Turns Ratio (≤ ±3%)			1:1	1:1	*1:1*	1:1	1:1	
Insertion Loss (at 1.0 kH	z)	dB	≤ 1.5	≤ 1.4	≤ 1.2	≤ 1.7	≤ 1.5	
Return Loss		dB	≥ 14	≥ 15	≥ 16	≥ 20	≥ 20	
Shunt Loss (typical)		kΩ	4.0	4.0	14.0	14.0	14.0	
Frequency Response (typ./0.3 - 3.5 kHz)		dB	±0.7	6.0±	±0.5	±0.8	±0.5	
Wide Band Response (0.1 - 10.0 kHz)		dB	±2.5	±1.4	±1.3	±3.0	±2.5	
Power Level (0 ADC)		dB	- 45.0 to + 3.0					
Longitudinal Balance (0.3 - 5.0 kHz)		dB			≥ 60.0			
Distortion (0 dB/at 0.3 k	Hz)	%			≤ 0.5			
Leakage Induction (typic	cal)	mH	68	68	75	75	75	
Dielectric Strength (P/S)		kVAC		1.5 (Prim to Sec and	Core)		
Temperature Range	Operation	°C			0 to +60			
	Storage	°C			-20 to +70			
Specifications Met					FCC Part 68	X X		



SURFACE MOUNT LINE MATCHING TRANSFORMERS

- Subminiature in SMT
- 7.1mm seated height No. 1 = 1
- Tested at 6.5kV
- Distortion of only 0.015%
- Vacuum encapsulated
- EN 41003
- EN 60950 and BS 415 approval
- Weight 2g

SM-LP-5001 Series

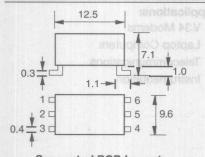
Bourns® Line Matching Models

ELECTRICAL SPECIFICATIONS

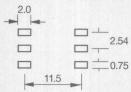
Nominal Impedance	600Ω	DC Resistance**	Primary 115Ω
Turns Ratio	1:1	±15%	Secondary 115Ω
Insertion Loss	2.0 dB max. at 2 kHz	Shunt Inductance	3.8 H min.
Frequency Response	±0.25 dB max. 200-4 kHz	Shunt Loss	7500Ω min.
Return Loss	24 dB min. 200-4 kHz*	Leakage Inductance	6-7 mH @ 1 kHz
Balance	80 dB min.	Power Level	10 dBm
Distortion	-76 dB max.	Operating Temperature	0°C to 70°C
Dielectric Strength	4600 Vrms for 1 min.	Storage Temperature	-40°C to +125°C
Insulation Resistance	100 MΩ @ 500 V	V 008 @ ΩM 007	Insulation Resistance

*For use with recommended circuit (BS6305 impedance Class A non-speech or Class B speech)

**SM-LP-5001 is symetrical meaning there is no real primary nor secondary winding

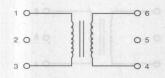


Suggested PCB Layout



All dimensions in mm

SCHEMATIC



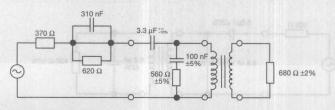
Applications:

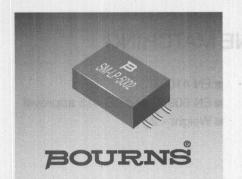
- Modems
- Laptop Computers
- Telecommunications
- Instrumentation

RECOMMENDED CIRCUITS 600 Ohms Matching (Speech)

6.8 μF ±20% 6.8 nF ±5% 6.8 nF ±5%

BS6305 Class (A) Matching (Non-speech)





SURFACE MOUNT LINE MATCHING TRANSFORMERS

- Ultra-low profile and small size
- Low distortion
- High dielectric insulation
- Vacuum encapsulated
- Meets or exceeds requirements of most international safety standards

■ Tested to 4600 Vrms

SM-LP-5002 Series

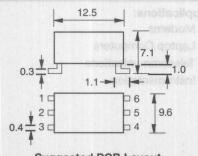
Bourns® Line Matching Models

ELECTRICAL SPECIFICATIONS

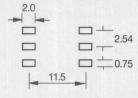
Nominal Impedance	600Ω	DC Resistance**	Primary 115Ω
Turns Ratio	1:1 W3f±	±15%	Secondary 115Ω
Insertion Loss	2.0 dB max. at 2 kHz	Shunt Inductance	3.8 H min.
Frequency Response	±0.25 dB max. 200-4 kHz	Shunt Loss	7500Ω min.
Return Loss	24 dB min. 200-4 kHz*	Leakage Inductance	6-7 mH @ 1 kHz
Longitudinal Balance	80 dB min.	.elm 8b 08	Balance
Distortion Organia and	-82 dB max. @ 600 Hz, -10 dBm	-76 dB max. /	Distortion
Dielectric Strength	4600 Vrms for 1 min.	4600 Vents for 1 min	
Insulation Resistance	100 MΩ @ 500 V	V 003 © QM 031	

*For use with recommended circuit (BS6305 impedance Class A non-speech or Class B speech)

**SM-LP-5002 is symetrical meaning there is no real primary nor secondary winding

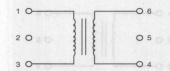


Suggested PCB Layout



All dimensions in mm

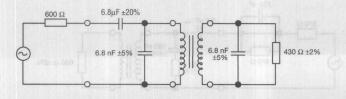
SCHEMATIC OTTAMENOR



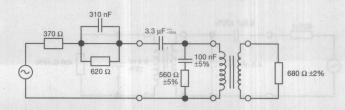
Applications:

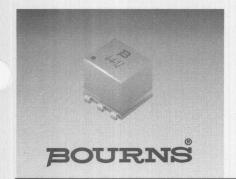
- V.34 Modems
- Laptop Computers
- Telecommunications
- Instrumentation

RECOMMENDED CIRCUITS 600 Ohms Matching (Speech)



BS6305 Class (A) Matching (Non-speech)





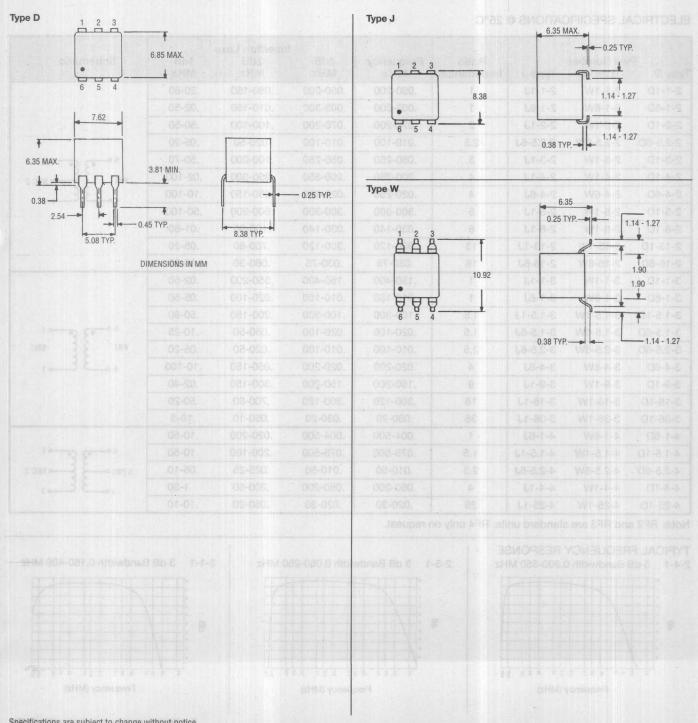
WIDEBAND RF TRANSFORMERS -THROUGH-HOLE AND SMD

- Fully encapsulated
- 6 pin DIP and SMD

- Low profile
- Low insertion loss
- Frequency range 10 kHz to 500 MHz
- Impedance levels from 12.5 Ω to 800 Ω (nominal 50 Ω)

RF2, RF3, RF4 Series

Bourns® Wideband RF Transformers



RF2, RF3, RF4 Series

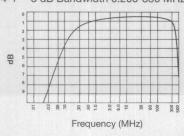
Bourns® Wideband RF Transformers

ELECTRICAL SPECIFICATIONS @ 25°C

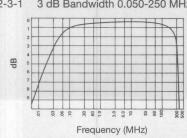
ype D	Part Number Type W	Type J	Ratio Impedance	Frequency MHz	3dB MHz	Insertion Loss 2dB MHz	1dB MHz	Sch	nematio	
2-1-1D	2-1-1W	2-1-1J	1	.050-200	.050-200	.080-150	.20-80			
2-1-6D	2-1-6W	2-1-6J	1	.003-300	.003-300	.010-150	.02-50			
2-2-1D	2-2-1W	2-2-1J	2	.070-200	.070-200	.100-100	.50-50			
2-2.5-60	2-2.5-6W	2-2.5-6J	2.5	.010-100	.010-100	.020-50	.05-20			
2-3-1D	2-3-1W	2-3-1J	3	.050-250	.050-250	.100-200	.50-70	60_	•) (•	⊸ 1
2-4-1D	2-4-1W	2-4-1J	4	.200-350	.200-350	.350-300	.02-100	PRI	3 8	→ SEC
2-4-6D	2-4-6W	2-4-6J	4	.020-250	.020-250	.050-150	.10-100	1	38	-0 3
2-5-1D	2-5-1W	2-5-1J	5	.300-300	.300-300	.600-200	.50-100	-0		3
2-8-1D	2-8-1W	2-8-1J	8	.030-140	.030-140	.100-90	.01-60	ac-min		
2-13-1D	2-13-1W	2-13-1J	13	.300-120	.300-120	.700-80	.05-20	Byt		
2-16-6D	2-16-6W	2-16-6J	16	.030-75	.030-75	.060-30	.10-20	MG TELL		
3-1-1D	3-1-1W	3-1-1J	1	.150-400	.150-400	.350-200	.02-50			
3-1-6D	3-1-6W	3-1-6J	1	.010-150	.010-150	.020-100	.05-50			
3-1.5-10	3-1.5-1W	3-1.5-1J	1.5	.100-300	.100-300	.200-150	.50-80			
3-1.5-60	3-1.5-6W	3-1.5-6J	1.5	.020-100	.020-100	.050-50	.10-25	60-	•3 &	-0 1
3-2.5-6[3-2.5-6W	3-2.5-6J	2.5	.010-100	.010-100	.020-50	.05-20	PRI	3 8	SEC
3-4-6D	3-4-6W	3-4-6J	4	.020-200	.020-200	.050-150	.10-100	4 0_	38	— 03
3-9-1D	3-9-1W	3-9-1J	9	.150-200	.150-200	.300-150	.02-40			
3-16-1D	3-16-1W	3-16-1J	16	.300-120	.300-120	.700-80	.50-20			
3-36-1D	3-36-1W	3-36-1J	36	.030-20	.030-20	.050-10	.10-5			
4-1-6D	4-1-6W	4-1-6J	1	.004-500	.004-500	.020-200	.10-50			
4-1.5-1	4-1.5-1W	4-1.5-1J	1.5	.075-500	.075-500	.200-100	.10-50	60-	36	-0 1
4-2.5-60	4-2.5-6W	4-2.5-6J	2.5	.010-50	.010-50	.025-25	.05-10	5 PRI 0—	38	→ SEC
4-4-1D	4-4-1W	4-4-1J	4	.050-200	.050-200	.200-50	1-30	40-	3 E	— 0 3
4-25-1D	4-25-1W	4-25-1J	25	.020-30	.020-30	.050-20	.10-10			

Note: RF2 and RF3 are standard units. RF4 only on request.

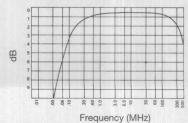
TYPICAL FREQUENCY RESPONSE 2-4-1 3 dB Bandwidth 0.200-350 MHz

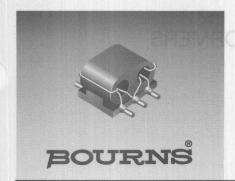


3 dB Bandwidth 0.050-250 MHz



3-1-1 3 dB Bandwidth 0.150-400 MHz





- SMD gull-wing
- High frequency
- Low Z tolerance ±10%

0604 Series

Bourns® Chip Balun Transformers

	Α	В	С	E	F
8 mm 8	6.0 ±0.3	6.5 ±0.5	4.2 ±0.5	2.0 ±0.2	5.8 ±0.3

ELECTRICAL DATA

Frequency	20 MHz	40MHz	100 MHz	200 MHz	400 MHz	600 MHz	854 MHz
Z (1 – 3)	125 Ω	165 Ω	210 Ω	230 Ω	240 Ω	250 Ω	275 Ω

ENVIRONMENTAL CHARACTERISTICS

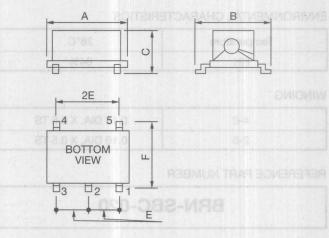
Temperature	16°C
RH	89%

WINDING

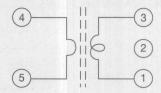
4-5	^{2×} 0.16 DIA. X 0.5 TS	
1-3	0.16 DIA, X 0.5 TS	

REFERENCE PART NUMBER

BRN-SBC-022



DIMENSIONS IN MM





- SMD gull-wing
- High frequency
- Low Z tolerance

0604 Series

Bourns® Chip Balun Transformers

	A	В	С	E	F
8 mm 3	6.0 ±0.3	6.5 ±0.5	4.2 ±0.5	2.0 ±0.2	5.8 ±0.3

ELECTRICAL DATA

Frequency	20 MHz	40MHz	100 MHz	200 MHz	400 MHz	600 MHz	854 MHz
Z ±10%	125 Ω	170 Ω	208 Ω	225 Ω	235 Ω	250 Ω	275 Ω

ENVIRONMENTAL CHARACTERISTICS

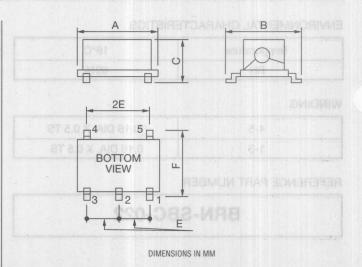
Temperature	28°C
RH	84%

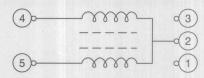
WINDING

4-2	0.16 DIA. X 0.5 TS
2-5	0.16 DIA. X 0.5 TS

REFERENCE PART NUMBER

BRN-SBC-020







- SMD gull-wing
- High frequency
- Low Z tolerance ±10%
- Low impedance

0604 Series

Bourns® Chip Balun Transformers

	A	В	С	E	F
E mm a	6.1 ±0.3	6.5 ±0.5	4.2 ±0.5	2.0 ±0.2	5.8 ±0.3

ELECTRICAL DATA

Frequency	47 MHz	230 MHz	470 MHz	860 MHz
Z (1-5)	0 0 85 Ω	140 Ω	150 Ω	185 Ω

ENVIRONMENTAL CHARACTERISTICS

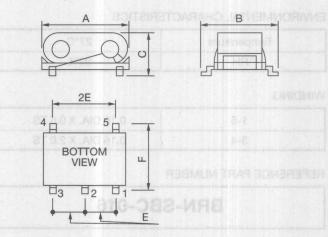
Temperature	27°C
RH	92%

WINDING

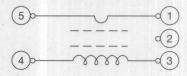
1-5	0.16 DIA. X 0.5 TS	
3-4	0.16 DIA. X 1.0 TS	

REFERENCE PART NUMBER

BRN-SBC-015



DIMENSIONS IN MM





Low (mpedance

- SMD gull-wing
- High frequency
- Low Z tolerance ±10% Woll at

0604 Series

Bourns® Chip Balun Transformers

	A	В	C	Ex	F
mm	6.1 ±0.3	6.5 ±0.5	4.2 ±0.5	2.0 ±0.2	5.8 ±0.3

ELECTRICAL DATA

Frequency	47 MHz	230 MHz	470 MHz	860 MHz
Z (1-5)	Ω 200 Ω	Ω 0 330 Ω	350 Ω	410 Ω

ENVIRONMENTAL CHARACTERISTICS

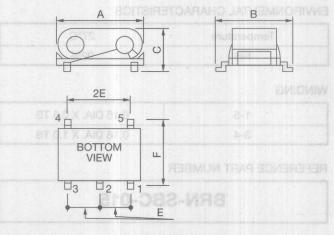
Temperature	27°C
RH	92%

WINDING

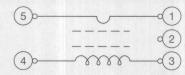
1-5	0.16 DIA. X 0.5 TS
3-4	0.16 DIA. X 2.0 TS

REFERENCE PART NUMBER

BRN-SBC-016



DIMENSIONS IN MM





- SMD gull-wing to GMB #sm8 a
- High frequency sHD total w
- Low Z tolerance ±10%

0604 Series

Bourns® Chip Balun Transformers

	A	В	C	E	F
9 mm 4	6.1 ±0.3	6.5 ±0.5	4.2 ±0.5	2.0 ±0.2	5.8 ±0.3

ELECTRICAL DATA

Frequency	47 MHz	230 MHz	470 MHz	860 MHz
Z (1-5)	340 Ω	580 Ω Ω στ	630 Ω 000	760 Ω

ENVIRONMENTAL CHARACTERISTICS

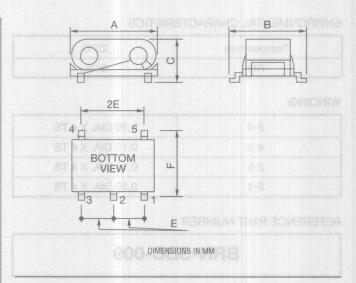
Temperature	27°C
DLI	020/

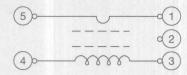
WINDING

1-5	0.16 DIA. X 0.5 TS
3-4	0.16 DIA. X 3.0 TS

REFERENCE PART NUMBER

BRN-SBC-017







- Small SMD size
- Up to 1 GHz frequency
- Z tolerance ±10% from 350 MHz up

0303 Series

Bourns® Chip Balun Transformers

A Black II	A	В	С	E	F
mm	3.8 ±0.3	4.8 ±0.5	3.3 ±0.5	1.27 ±0.3	4.3 ±0.2

ELECTRICAL DATA

Frequency	100 MHz	350 MHz	500 MHz	800 MHz	1 GHz
Z (4-5)	1000 Ω	110 Ω	72 Ω	41 Ω	31 Ω

ENVIRONMENTAL CHARACTERISTICS

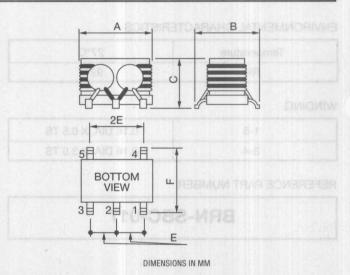
Temperature	25°C
RH	91%

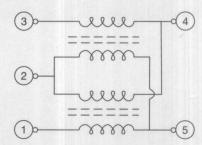
WINDING

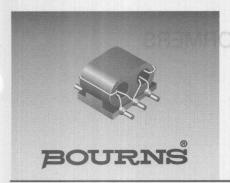
0.10 DIA. X 4 TS
0.10 DIA. X 4 TS
0.10 DIA. X 4 TS
0.10 DIA. X 4 TS

REFERENCE PART NUMBER

BRN-SBC-009







- SMD gull-wing
- High frequency
- Low Z tolerance ±10%

0604 Series

Bourns® Chip Balun Transformers

生力技術	A	В	C	E	F
S.O-mm	6.0 ±0.3	6.5 ±0.5	4.2 ±0.5	2.0 ±0.2	5.8 ±0.3

ELECTRICAL DATA

Frequency	47 MHz	230 MHz	470 MHz	860 MHz
Z (4-5)	160 Ω	270 Ω	275 Ω	290 Ω

ENVIRONMENTAL CHARACTERISTICS

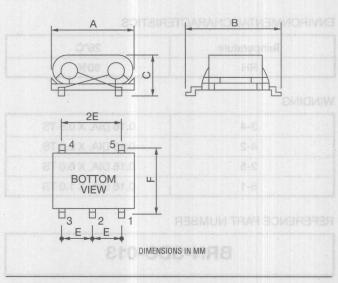
Temperature	27°C
RH	92%

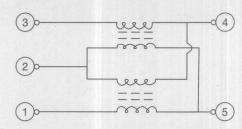
WINDING

3-4	0.16 DIA. X 0.5 TS
4-2	0.16 DIA. X 1.0 TS
5-1	0.16 DIA, X 0.5 TS
2-5	0.16 DIA. X 1.0 TS

REFERENCE PART NUMBER

TLV-BC-002A







- SMD gull-wing
- Low frequency
- Low impedance

0604 Series

Bourns® Chip Balun Transformers

	A	В	С	E	F	W
mm. 8.8	6.0±0.3	6.5±1.0	4.2±0.5	2.0±0.2	5.8±0.3	0.6±0.2

ELECTRICAL DATA

Frequency	1 MHz	3 MHz	10 MHz	30 MHz	100 MHz	200 MHz
Z (4-5)	4.5 Ω	12 Ω	42 Ω	120 Ω	220 Ω	270 Ω

ENVIRONMENTAL CHARACTERISTICS

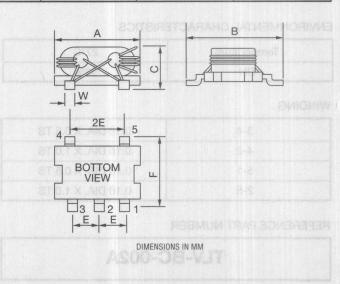
Temperature	26°C
RH	90%

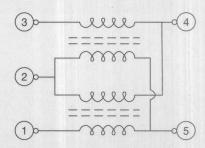
WINDING

3-4	0.16 DIA. X 0.5 TS
4-2	0.16 DIA. X 2.0 TS
2-5	0.16 DIA. X 6.0 TS
5-1	0.16 DIA. X 1.0 TS

REFERENCE PART NUMBER

BRN-SBC-013







- SMD gull-wing
- Low frequency
- Z tolerance ±15%

0604 Series

Bourns® Chip Balun Transformers

	Α	B SOSAN	С	E	F	W
mm	6.0±0.3	6.5±1.0	4.2±0.5	2.0±0.2	5.8±0.2	0.6±0.2

ELECTRICAL DATA

Frequency	1 MHz	3 MHz	10 MHz	30 MHz	100 MHz	200 MHz
Z (4-5)	30 Ω	90 Ω	380 Ω	1280 Ω	320 Ω	70 Ω

ENVIRONMENTAL CHARACTERISTICS

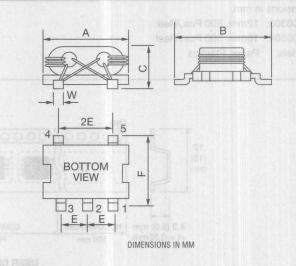
Temperature	26°C
RH	92%

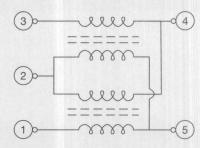
WINDING

3-4	0.12 DIA. X 4 TS
4-2	0.12 DIA. X 4 TS
2-5	0.12 DIA. X 4 TS
5-1	0.12 DIA. X 4 TS

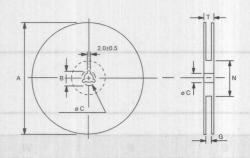
REFERENCE PART NUMBER

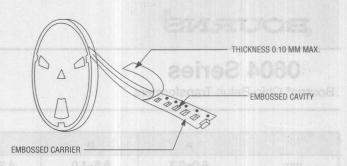
BRN-SBC-005





CHIP BALUN TRANSFORMERS PACKAGING SPECIFICATIONS





Type	A	В	С	G	N	Т
12mm	178	24±1	13±0.5	14.0	50-0	18.4
16mm	178	24±1	13±0.5	18.0	50-0	22.4

TOP COVER TAPE

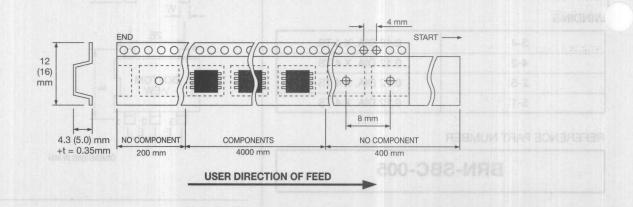
BASE TAPE

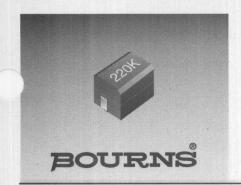
Dimensions in mm.

**SBC0303: 12mm, 500 Pcs./Reel **SBC0604: 16mm, 500 Pcs./Reel

Materials: Paper, Plastics

STRENGTH OF COVER TAPE: The force for tearing off cover tape is 10 to 130 grams in the arrow direction.





SMT CHIP INDUCTORS

- High resistance to heat and humidity
- Resistance to mechanical shock and pressure
- Accurate dimensions for automatic surface mounting

CM322522/CM453232 Series

Bourns® SMT Chip Inductors

STANDARD SPECIFICATIONS

	CM32252	CM453232
Temperature rise	20°C max.	20°C max.
Ambient temperature	80°C max.	80°C max.
Operating temperature	-20 to +100°C	-25 to +100°C
Storage temperature	-40 to +100°C	-40 to +100°C
Terminal tensile strength	0.5 kg min.	1 kg min.
Current rating: Current cause inductance drop within 10%	0 to +55°C	0 to +50°C
Resistance to soldering heat	260°C for 10 sec	260°C for 10 sec
Resistance to solvent	Mil-Std-202 F	Mil-Std-202 F

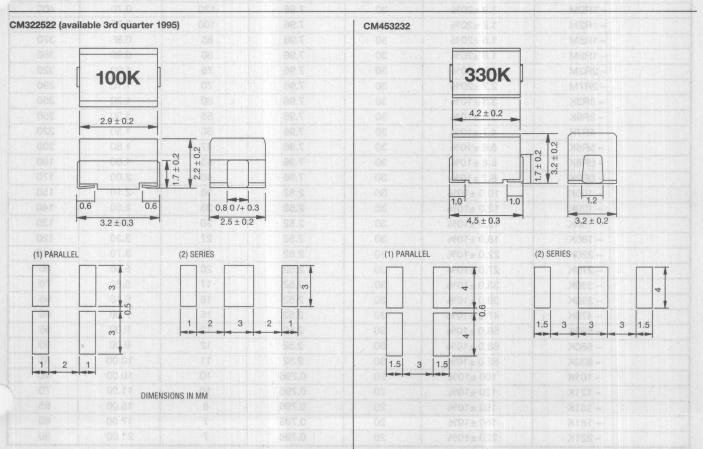
These high reliable wirewound chip inductors for automatic mounting have been developed in response to the trend toward higher density mounting of parts in electric circuits.

MATERIALS:

Core: Ferrite DR core
Wire: Enamelled copy

Wire: Enamelled copper wire
Terminal: Tinned copper flat
Encapsulate: Epoxy novolac

molding compound



SMT CHIP INDUCTORS

m Resistance to mechanical shock and pressure in Accurate dimensions for automatic surface mounting

CM322522/CM453232 Series

Bourns® SMT Chip Inductors

ELECTRICAL SPECIFICATIONS

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)	SRF min. (MHz)	RDC max. (Ω)	IDC (mA
CM322522 - R10M	0.10 ±20%	30	25.2	520	0.20	450
- R12M	0.12 ±20%	30	25.2	500	0.22	450
- R15M	0.15 ±20%	30	25.2	450	0.25	450
- R18M	0.18 ±20%	30	25.2	400	0.28	450
- R22M	0.22 ±20%	30	25.2	350	0.32	450
- R27M	0.27 ±20%	30	25.2	320	0.36	450
- R33M	0.33 ±20%	30	25.2	300	0.40	450
- R39M	0.39 ±20%	30	25.2	250	0.45	. 450
- R47M	0.47 ±20%	30	25.2	220	0.50	450
- R56M	0.56 ±20%	30	25.2	180	0.55	450
- R68M	0.68 ±20%	30	25.2	160	0.60	450
- R82M	0.82 ±20%	30	25.2	140	0.65	450
- 1R0M	1.0 ±20%	30	7.96	120	0.70	400
- 1R2M	1.2 ±20%	30	7.96	100	0.75	390
- 1R5M	1.5 ±20%	30	7.96	85	0.85	370
- 1R8M	1.8 ±20%	30	7.96	80	0.90	350
- 2R2M	2.2 ±20%	30	7.96	75	1.00	320
- 2R7M	2.7 ±20%	30	7.96	70	1.10	290
- 3R3K	3.3 ±10%	30	7.96	60	1.20	260
- 3R9K	3.9 ±10%	30	7.96	55	1.30	250
- 4R7K	4.7 ±10%	30	7.96	50	1.50	220
- 5R6K	5.6 ±10%	30	7.96	47	1.60	200
- 6R8K	6.8 ±10%	30	7.96	. 43	1.80	180
- 8R2K	8.2 ±10%	30	7.96	40	2.00	170
- 100K	10.0 ±10%	30	2.52	36	2.10	150
- 120K	12.0 ±10%	30 /	2.52	33	2.50	140
- 150K	15.0 ±10%	30	2.52	30	2.80	130
- 180K	18.0 ±10%	30	2.52	27	3.30	120
- 220K	22.0 ±10%	30	2.52	25	3.70	110
- 270K	27.0 ±10%	30	2.52	20	5.00	80
- 330K	33.0 ±10%	30	2.52	-17	5.60	70
- 390K	39.0 ±10%	30	2.52	16	6.40	65
- 470K	47.0 ±10%	30	2.52	15	7.00	60
- 560K	56.0 ±10%	30	2.52	13	8.00	55
- 680K	68.0 ±10%	30	2.52	12	9.00	50
- 820K	82.0 ±10%	30	2.52	11	10.00	45
- 101K	100 ±10%	20	0.796	10	10.00	40
- 121K	120 ±10%	20	0.796	10	11.00	70
- 151K	150 ±10%	20	0.796	8	15.00	65
- 181K	180 ±10%	20	0.796	7	17.00	60
- 221K	220 ±10%	20	0.796	7	21.00	50

CM322522 available 3rd quarter 1995

CM322522/CM453232 Series

Bourns® SMT Chip Inductors

ELECTRICAL SPECIFICATIONS

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)	SRF min. (MHz)	RDC max. (Ω)	IDC (mA
CM453232 - R10M	0.10 ±20%	35	25.2	300	0.18	800
- R12M	0.12 ±20%	35	25.2	280	0.20	770
- R15M	0.15 ±20%	35	25.2	250	0.22	730
- R18M	0.18 ±20%	35	25.2	220	0.24	700
- R22M	0.22 ±20%	40	25.2	200	0.25	665
- R27M	0.27 ±20%	40	25.2	180	0.26	635
- R33M	0.33 ±20%	40	25.2	165	0.28	605
- R39M	0.39 ±20%	40	25.2	150	0.30	575
- R47M	0.47 ±20%	40	25.2	145	0.32	545
- R56M	0.56 ±20%	40	25.2	140	0.36	520
- R68M	0.68 ±20%	40	25.2	135	0.40	500
- R82M	0.82 ±20%	40	25.2	130	0.45	475
- 1R0K	1.0 ±10%	50	7.96	100	0.50	450
- 1R2K	1.2 ±10%	50	7.96	80	0.55	430
- 1R5K	1.5 ±10%	50	7.96	70	0.60	410
- 1R8K	1.8 ±10%	50	7.96	60	0.65	390
- 2R2K	2.2 ±10%	50	7.96	55	0.70	380
- 2R7K	2.7 ±10%	50	7.96	50	0.75	370
- 3R3K	3.3 ±10%	50	7.96	45	0.80	355
- 3R9K	3.9 ±10%	50	7.96	40	0.90	330
- 4R7K	4.7 ±10%	50	7.96	35	1.00	315
- 5R6K	5.6 ±10%	50	7.96	33	1.10	300
- 6R8K	6.8 ±10%	50	7.96	27	1.20	285
- 8R2K	8.2 ±10%	50	7.96	25	1.40	270
- 100K	10.0 ±10%	50	2.52	20	1.60	250
- 120K	12.0 ±10%	50	2.52	18	2.00	225
- 150K	15.0 ±10%	50	2.52	17	2.50	200
- 180K	18.0 ±10%	50	2.52	15	2.80	190
- 220K	22.0 ±10%	50	2.52	13	3.20	180
- 270K	27.0 ±10%	50	2.52	12	3.60	170
- 330K	33.0 ±10%	50	2.52	11	4.00	160
- 390K	39.0 ±10%	50	2.52	10	4.50	150
- 470K	47.0 ±10%	50	2.52	10	5.00	140
- 560K	56.0 ±10%	50	2.52	9.0	5.50	135
- 680K	68.0 ±10%	50	2.52	9.0	6.00	130
- 820K	82.0 ±10%	50	2.52	8.0	7.00	120
- 101K	100 ±10%	40	0.796	8.0	8.00	110
- 121K	120 ±10%	40	0.796	6.0	8.00	110
- 151K	150 ±10%	40	0.796	5.0	9.00	105
- 181K	180 ±10%	40	0.796	5.0	9.50	102

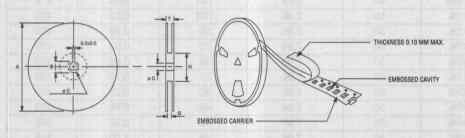
CM322522/CM453232 Series

Bourns® SMT Chip Inductors

ELECTRICAL SPECIFICATIONS

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)	SRF min. (MHz)	RDC max. (Ω)	IDC (mA)
CM453232-221K	220 ±10%	40	0.796	4.0	10.0	100
-271K	270 ±10%	40	0.796	4.0	12.0	92
-331K	330 ±10%	40	0.796	3.5	14.0	85
-391K	390 ±10%	40	0.796	3.0	18.0	80
-471K	470 ±10%	40	0.796	3.0	26.0	62
- 561K	560 ±10%	30	0.796	3.0	30.0	50
- 681K	680 ±10%	30	0.796	3.0	30.0	50
- 821K	820 ±10%	30	0.796	2.5	35.0	30
- 102K	1000 ±10%	30	0.252	2.5	40.0	30

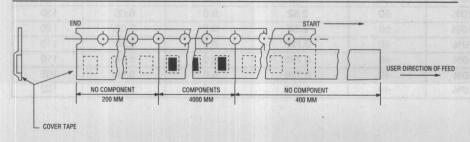
CARRIER TAPE REELS



REEL DIMENSIONS (MM)

Туре	Α	В	C	G	N	T
8mm	178	21.0 ±0.8	13.0±0.5	10	50-⁰	14.4 + 0
12mm	178	21.0 ±0.8	13±0.5	14	50-⁰	18.4 + 0

Materials: Paper, Plastics CM322522: 2000 pcs./reel CM453232: 500 pcs./reel

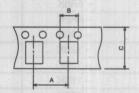


PART NUMBER

CM	32	25	22	-	100	K
(1)	(2)	(3)	(4)		(5)	(6)

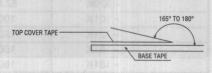
- (1) Chip coil molding type(2) Coil length: 3.2mm
- (3) Coil width: 2.5mm
- (4) Coil height: 2.2mm
- (5) Inductance: 10.0 µH
- (6) Tolerance: ±10%

TAPE DIMENSIONS (MM)



Туре	A	В	С
CM32	4	4	8
CM45	8	4	12

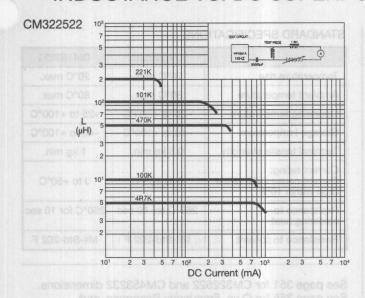
STRENGTH OF COVER TAPE

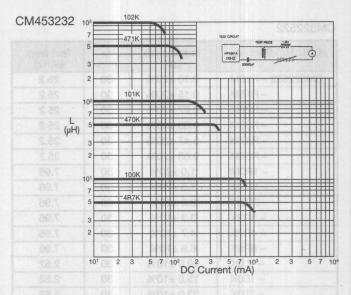


The force for tearing off cover tape is 10 to 130 grams in the arrow direction.

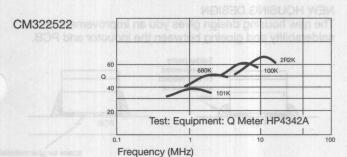
Specifications are subject to change without notice.

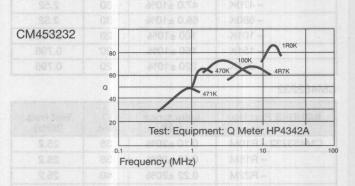
INDUCTANCE VS. DC SUPERPOSITION CHARACTERISTICS





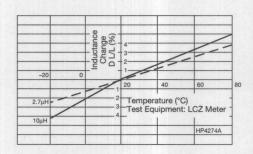
Q VS. FREQUENCY RESPONSE

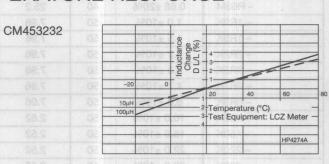




INDUCTANCE CHANGE VS. TEMPERATURE RESPONSE

CM322522







CHIP INDUCTOR LAB KITS 12097339U2 00 2V 30MATDUOM

CM322522

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)
CM322522 - R10M	0.10 ±20%	30	25.2
- R15M	0.15 ±20%	30	25.2
- R22M	0.22 ±20%	30	25.2
- R33M	0.33 ±20%	30	25.2
- R47M	0.47 ±20%	30	25.2
- R68M	0.68 ±20%	30	25.2
- 1R0M	1.0 ±20%	30	7.96
- 1R5M	1.5 ±20%	30	7.96
- 2R2M	2.2 ±20%	30	7.96
- 3R3K	3.3 ±10%	30	7.96
- 4R7K	4.7 ±10%	30	7.96
- 6R8K	6.8 ±10%	30	7.96
- 100K	10.0 ±10%	30	2.52
- 150K	15.0 ±10%	30	2.52
- 220K	22.0 ±10%	30	2.52
- 330K	33.0 ±10%	30	2.52
- 470K	47.0 ±10%	30	2.52
- 680K	68.0 ±10%	30	2.52
- 101K	100 ±10%	20	0.796
– 151K	150 ±10%	20	0.796
- 221K	220 ±10%	20	0.796

CM452232

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)
CM453232 - R10M	0.10 ±20%	35	25.2
- R15M	0.15 ±20%	35	25.2
- R22M	0.22 ±20%	40	25.2
- R33M	0.33 ±20%	40	25.2
- R47M	0.47 ±20%	40	25.2
- R68M	0.68 ±20%	40	25.2
- 1R0K	1.0 ±10%	50	7.96
– 1R5K	1.5 ±10%	50	7.96
- 2R2K	2.2 ±10%	50	7.96
- 3R3K	3.3 ±10%	50	7.96
- 4R7K	4.7 ±10%	50	7.96
- 6R8K	6.8 ±10%	50	7.96
-100K	10.0 ±10%	50	2.52
- 150K	15.0 ±10%	50	2.52
- 220K	22.0 ±10%	50	2.52
- 330K	33.0 ±10%	50	2.52
- 470K	47.0 ±10%	50	2.52
- 680K	68.0 ±10%	50	2.52
- 101K	100 ±10%	40	0.796
- 151K	150 ±10%	40	0.796
- 221K	220 ±10%	40	0.796
- 331K	330 ±10%	40	0.796
- 471K	470 ±10%	40	0.796
- 681K	680 ±10%	30	0.796
- 102K	1000 ±10%	30	0.252

The LAB-Kits are including E6 series, 10 pieces per value.

CM45-LAB1: available

CM32-LAB1: available 3rd quarter 1995

STANDARD SPECIFICATIONS

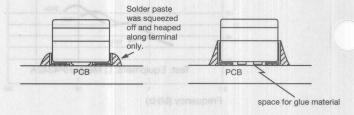
The second section of	CM322522	CM453232
Temperature rise	20°C max.	20°C max.
Ambient temperature	80°C max.	80°C max.
Operating temperature	-20 to +100°C	-25 to +100°C
Storage temperature	-40 to +100°C	-40 to +100°C
Terminal tensile strength	0.5 kg min.	1 kg min.
Current rating: Current cause inductance drop within 10%	0 to +55°C	0 to +50°C
Resistance to soldering heat	260°C for 10 sec	260°C for 10 sec
Resistance to solvent	Mil-Std-202 F	Mil-Std-202 F

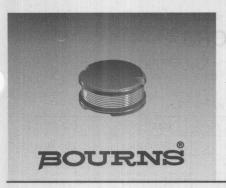
See page 351 for CM322522 and CM453232 dimensions. See page 355 for Q vs. Frequency Response, and Inductance Change vs. Temperature Response Charts.

NEW HOUSING DESIGN

The new housing design gives you an improvement in solderability and glueing between the inductor and PCB.

INDUCTANCE CHANGE VS. TEM





SMD POWER INDUCTORS

- Available in E12 series
- Small design of only 7.8mm diameter

SDR0805 Series

Bourns® SMD Power Inductors

ELECTRICAL SPECIFICATIONS

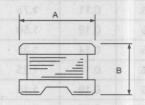
Bourns Part No.	L (µH)	RDC (Ω) max.	IDC (A) max.
SDR0805- 100 M	10 ± 20%	0.07	2.30
- 120 M	12 ± 20%	0.08	2.00
- 150 M	15 ± 20%	0.09	1.80
- 180 M	18 ± 20%	0.10	1.60
- 220 M	22 ± 20%	0.11	1.50
- 270 K	27 ± 10%	0.12	1.30
- 330 K	33 ± 10%	0.14	1.20
- 390 K	39 ± 10%	0.16	1.10
- 470 K	47 ± 10%	0.20	1.00
- 560 K	56 ± 10%	0.24	0.94
- 680 K	68 ± 10%	0.30	0.85
- 820 K	82 ± 10%	0.37	0.78
- 101 K	100 ± 10%	0.45	0.72
- 121 K	120 ± 10%	0.48	0.66
- 151 K	150 ± 10%	0.68	0.58
- 181 K	180 ± 10%	0.77	0.51
- 221 K	220 ± 10%	0.96	0.49
- 271 K	270 ± 10%	1.11	0.42
- 331 K	330 ± 10%	1.26	0.40
- 391 K	390 ± 10%	1.77	0.36
- 471 K	470 ± 10%	1.96	0.34

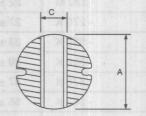
PART NUMBER

<u>SDR</u> 08 05 - 100 K (1) (2) (3) (4) (5)

- (1) DR Core for surface mounting
- (2) Outside Diameter: 8.0mm max.
- (3) Body Height: 5.5mm max.
- (4) Inductance: 10µH
- (5) Tolerance: (K: ±10%, M: ±20%)

CONFIGURATION





DIMENSIONS

A: 7.8+0 mm

B: 5.3⁺⁰ mm

C: 2.6 typ. mm

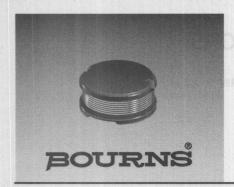
MATERIALS

Core:Ferrite DR core

Wire:Enamelled copper wire

Terminal Electrode:.....Ag & Sn/Pb

Temperature Rise:......40°C max. at rated current



SMD POWER INDUCTORS

- Available in E12 series
- High DC current

SDR1006 Series

Bourns® SMD Power Inductors

ELECTRICAL SPECIFICATIONS

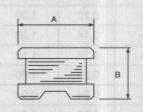
Bourns Part No.	L (µH)	RDC (Ω) max.	IDC (A) max.
SDR1006 - 100 M	10 ± 20%	0.06	2.60
- 120 M	12 ± 20%	0.07	2.45
- 150 M	15 ± 20%	0.08	2.25
- 180 M	18 ± 20%	0.09	2.15
- 220 M	22 ± 20%	0.10	1.95
- 270 K	27 ± 10%	0.11	1.75
- 330 K	33 ± 10%	0.12	1.50
- 390 K	39 ± 10%	0.14	1.35
- 470 K	47 ± 10%	0.17	1.25
- 560 K	56 ± 10%	0.19	1.15
- 680 K	68 ± 10%	0.22	1.10
- 820 K	82 ± 10%	0.25	1.00
- 101 K	100 ± 10%	0.35	0.97
- 121 K	120 ± 10%	0.40	0.89
- 151 K	150 ± 10%	0.47	0.78
- 181 K	180 ± 10%	0.63	0.72
- 221 K	220 ± 10%	0.73	0.66
- 271 K	270 ± 10%	0.97	0.57
- 331 K	330 ± 10%	1.15	0.52
- 391 K	390 ± 10%	1.30	0.48
- 471 K	470 ± 10%	1.48	0.42
- 561 K	560 ± 10%	1.90	0.33
- 681 K	680 ± 10%	2.25	0.28
- 821 K	820 ± 10%	2.55	0.24

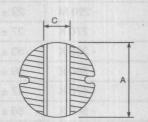
PART NUMBER

<u>SDR</u> <u>10</u> <u>06</u> - <u>100</u> <u>K</u> (1) (2) (3) (4) (5)

- (1) DR Core for surface mounting
- (2) Outside Diameter: 10.0 mm max.
- (3) Body Height: 6.0mm max.
- (4) Inductance: 10µH
- (5) Tolerance: (K: ±10%, M: ±20%)

CONFIGURATION





DIMENSIONS

- A: 9.8⁺⁰ mm
- B: 5.8⁺⁰ mm
- C: 2.9 typ. mm

MATERIALS

Core:Ferrite DR core

Wire:Enamelled copper wire

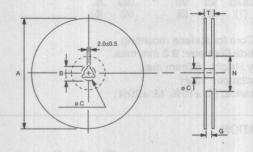
Terminal Electrode:.....Ag + Sn/Pb

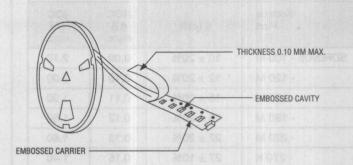
Temperature Rise:......40°C max. at rated current

SDR0805/SDR1006 Series

Bourns® SMD Power Inductors

CARRIER TAPE REELS





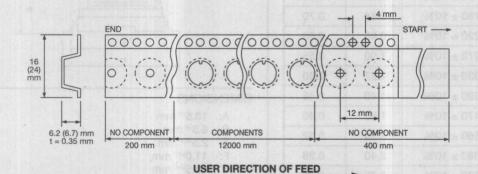
REEL DIMENSIONS (MM)

Туре	Α	В	С	G	N.	Т
16mm	330	24 ± 1	13.0 ± 0.5	18	50-0	23.5
24mm	330	24 ± 1	13.0 ± 0.5	26	50-⁰	31.5

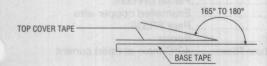
SDR0805: 16mm - 1000 pcs./reel SDR1006: 24mm - 1000 pcs./reel

MATERIALS:

Paper Plastics



STRENGTH OF COVER TAPE



The force for tearing off cover tape is 10 to 130 grams in the arrow direction.



SMD POWER INDUCTORS

- High inductance up to 1.2mH
- E12 series available

SDR0906 Series

Bourns® SMD Power Inductors

ELECTRICAL SPECIFICATIONS

Bourns Part No.	L (µH)	RDC (Ω) max.	IDC (A) max.
SDR0906 - 100 M	10 ± 20%	0.09	2.10
- 120 M	12 ± 20%	0.10	2.00
- 150 M	15 ± 20%	0.11	1.90
- 180 M	18 ± 20%	0.12	1.80
- 220 M	22 ± 20%	0.13	1.60
- 270 K	27 ± 10%	0.15	1.40
- 330 K	33 ± 10%	0.18	1.25
- 390 K	39 ± 10%	0.19	1.15
- 470 K	47 ± 10%	0.23	1.10
- 560 K	56 ± 10%	0.26	1.05
- 680 K	68 ± 10%	0.31	1.00
- 820 K	82 ± 10%	0.33	0.95
- 101 K	100 ± 10%	0.39	0.90
- 121 K	120 ± 10%	0.43	0.85
- 151 K	150 ± 10%	0.56	0.75
- 181 K	180 ± 10%	0.64	0.70
- 221 K	220 ± 10%	0.85	0.60
- 271 K	270 ± 10%	1.00	0.55
- 331 K	330 ± 10%	1.27	0.50
- 391 K	390 ± 10%	1.40	0.45
- 471 K	470 ± 10%	1.63	0.40
- 561 K	560 ± 10%	2.10	0.32
- 681 K	680 ± 10%	2.40	0.28
- 821 K	820 ± 10%	2.75	0.24
- 102 K	1000 ± 10%	3.50	0.22
- 122 K	1200 ± 10%	4.00	0.20

SCHEMATIC

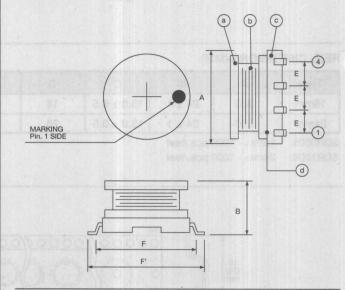


PART NUMBER

<u>SDR</u> <u>09</u> <u>06</u> - <u>100</u> <u>K</u> (1) (2) (3) (4) (5)

- (1) DR Core for surface mounting
- (2) Outside Diameter: 9.0 mm max.
- (3) Body Height: 6.3mm max.
- (4) Inductance: 10µH
- (5) Tolerance: (K: ±10%, M: ±20%)

CONFIGURATION



DIMENSIONS

A: 10.5⁺⁰ mm B: 6.3⁺⁰ mm E: 2.5^{±0.3} mm F: 11.0^{±0.5} mm F': 12.5^{±0.5} mm

MATERIALS

Core: Ferrite DR core

Wire: Enamelled copper wire

Base: Pept FR530

Adhesive: Epoxy

Temperature Rise: 40°C max. at rated current

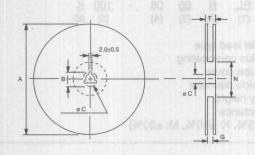
FIXED RADIAL LEAD INDUCTORS

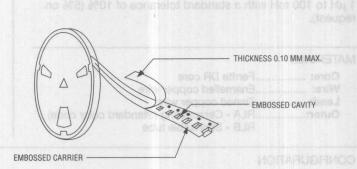
t High Q and low temperature rise (20°C max, at rated current)

SDR0906 Series

Bourns® SMD Power Inductors

CARRIER TAPE REELS





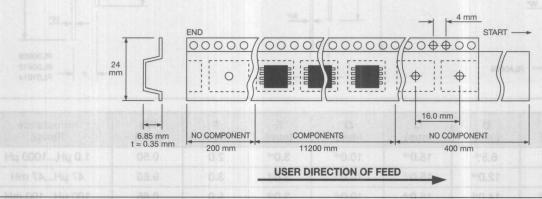
REEL DIMENSIONS (MM)

Туре	Α	В	C	G	N)	Т
24mm	330	24 ± 0.8	13.0 ± 0.5	26	50-⁰	31.5

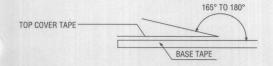
700 pcs./reel

MATERIALS:

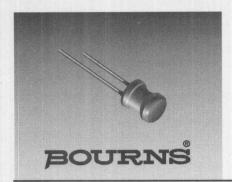
Paper Plastics



STRENGTH OF COVER TAPE



The force for tearing off cover tape is 10 to 130 grams in the arrow direction.



FIXED RADIAL LEAD INDUCTORS

- Three types available
- High Q and low temperature rise (20°C max. at rated current)
- Available in E12 series

RL0608/RL0812/RL1014 Series

Bourns® Leaded Inductors

These high quality radial fixed inductors are available from 1 μ H to 100 mH with a standard tolerance of 10% (5% on request).

MATERIALS

Core:Ferrite DR core

Wire:Enamelled copper wire

Lead:Tinned copper wire

Outer:.....RLA - Ceracoating (Standard color code)

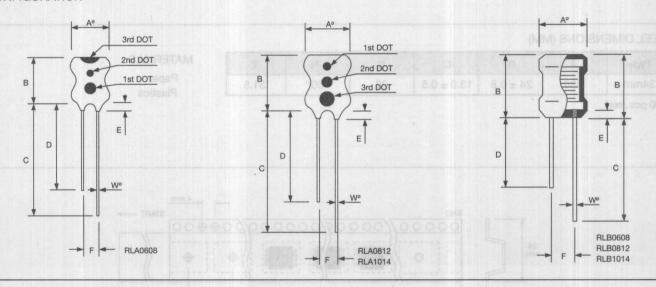
RLB - Shrinkable tube

PART NUMBER

<u>RL</u> <u>B</u> <u>06</u> <u>08</u> - <u>100</u> <u>K</u> (1) (2) (3) (4) (5) (6)

- (1) Radial lead type
- (2) A: Blue ceracoating B: Tube cover
- (3) Outside diameter
- (4) Body height
- (5) Inductance
- (6) (J: ±5%, K: ±10%, M: ±20%)

CONFIGURATION



Bourns P/N	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	Wø (mm)	Inductance Range
RL0608	6.0+0	8.5+0	15.0+0	10.0+0	3.0+0	2.0	0.50	1.0 μΗ1000 μΗ
RL0812	8.0+0	12.0+0	15.0+0	10.0+0	3.0+0	3.0	0.65	47 μH47 mH
RL1014	10.0+0	14.0+0	15.0 ⁺⁰	10.0+0	3.0+0	5.0	0.65	100 μH100 mH

Bourns® Leaded Inductors

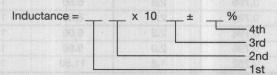
STANDARD COLOR CODE

C	Color Code	1st Significant Figure	2nd Significant Figure	3rd Multiplying Factor	4th L-Tolerance	
ВК	Black	0	0 00	1 20 20 21		
BN	Brown	1	1	10		
R	Red	2	2	100		
0	Orange	0.00 3	3	1000	±3%	
Υ	Yellow	0.06 4	4	2 × 2 × 3 × 3 × 3 × 3 × 3 × 3 × 3 × 3 ×	MEET-	
GN	Green	5	5			
BU	Blue	6 6	6		Tana - Car	
٧	Violet	0.08 7 88	7 08	GRU2252	H8984 -	
GY	Gray	8	8			
W	White	9	9	5 ago 1 5 5		
GD	Golden		(ABM A) Temporary	0.1	±5%	
SIL	Silver			0.01	±10%	
None	(Body color)				±20%	

3 COLOR CODE INDUCTANCE EXPRESSION

Example: $560 \mu H \pm 20\% = 56 \times 101$ (GN, BU, BN)

4 COLOR CODE INDUCTANCE EXPRESSION



Example: $150 \mu H \pm 10\% = 15 \times 10^{1}$ (BN, GN, BN, SIL)

Bourns® Leaded Inductors

RL0608 SERIES ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)	SRF (MHz) min.	RDC (Ω) max.	IDC (mA) max
RL 0608 - 1R0M	1.0 ± 20%	60	7.96	105.0	0.10	1030
- 1R2M	1.2 ± 20%	60	7.96	90.0	0.15	980
- 1R5M	1.5 ± 20%	60	7.96	75.0	0.20	920
- 1R8M	1.8 ± 20%	60	7.96	70.0	0.22	880
- 2R2M	2.2 ± 20%	60	7.96	65.0	0.24	830
- 2R7M	2.7 ± 20%	60	7.96	60.0	0.27	790
- 3R3M	3.3 ± 20%	60	7.96	50.0	0.30	750
- 3R9M	3.9 ± 20%	60	7.96	45.0	0.30	720
- 4R7M	4.7 ± 20%	60	7.96	40.0	0.35	670
- 5R6K	5.6 ± 10%	60	7.96	35.0	0.35	640
- 6R8K	6.8 ± 10%	60	7.96	30.0	0.40	620
- 8R2K	8.2 ± 10%	60	7.96	25.0	0.40	590
- 100K	10.0 ± 10%	60	2.52	20.0	0.45	550
- 120K	12.0 ± 10%	60	2.52	15.0	0.50	530
- 150K	15.0 ± 10%	60	2.52	13.0	0.55	500
- 180K	18.0 ± 10%	60	2.52	11.0	0.60	480
- 220K	22.0 ± 10%	60	2.52	10.0	0.65	460
- 270K	27.0 ± 10%	50	2.52	9.0	0.75	430
- 330K	33.0 ± 10%	50	2.52	8.0	0.85	410
- 390K	39.0 ± 10%	50	2.52	7.5	0.90	390
- 470K	47.0 ± 10%	50	2.52	7.0	1.00	370
- 560K	56.0 ± 10%	50	2.52	6.5	1.20	350
- 680K	68.0 ± 10%	50	2.52	6.0	1.30	340
- 820K	82.0 ± 10%	50	2.52	5.5	1.50	320
- 101K	100.0 ± 10%	50	0.796	5.0	1.70	305
- 121K	120.0 ± 10%	50	0.796	4.8	1.90	290
- 151K	150.0 ± 10%	50	0.796	4.4	2.10	275
- 181K	180.0 ± 10%	50	0.796	4.2	2.30	235
- 221K	220.0 ± 10%	45	0.796	3.8	2.50	200
- 271K	270.0 ± 10%	45	0.796	3.6	2.75	180
- 331K	330.0 ± 10%	45	0.796	3.3	4.68	165
- 391K	390.0 ± 10%	45	0.796	3.0	6.00	150
- 471K	470.0 ± 10%	55	0.796	2.8	6.50	140
- 561K	560.0 ± 10%	55	0.796	2.4	8.50	135
- 681K	680.0 ± 10%	55	0.796	2.2	9.00	125
- 821K	820.0 ± 10%	55	0.796	2.0	9.60	120
- 102K	1000.0 ± 10%	55	0.252	1.8	11.50	100

Packaging: 500 pieces in bags; 5000 pieces in a box

Bourns® Leaded Inductors

RL0812 SERIES ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)	SRF (MHz) min.	RDC (Ω) max.	IDC (mA) max
RL 0812 - 470K	47 ± 10%	30	2.520	6.00	0.40	450
- 560K	56 ± 10%	30	2.520	5.50	0.45	400
- 680K	68 ± 10%	30	2.520	5.00	0.50	360
- 820K	82 ± 10%	30	2.520	4.50	0.50	340
- 101K	100 ± 10%	45	0.796	4.20	0.60	320
- 121K	120 ± 10%	45	0.796	3.60	0.70	300
- 151K	150 ± 10%	45	0.796	3.40	0.90	280
- 181K	180 ± 10%	45	0.796	3.20	1.00	260
- 221K	220 ± 10%	45	0.796	3.00	1.20	240
- 271K	270 ± 10%	45	0.796	2.80	1.40	220
- 331K	330 ± 10%	45	0.796	2.50	1.60	200
- 391K	390 ± 10%	45	0.796	2.30	1.80	180
- 471K	470 ± 10%	45	0.796	2.20	2.00	160
- 561K	560 ± 10%	45	0.796	2.00	2.50	150
- 681K	680 ± 10%	45	0.796	1.70	2.90	140
- 821K	820 ± 10%	45	0.796	1.50	3.10	130
- 102K	1000 ± 10%	45	0.252	1.40	3.90	120
- 122K	1200 ± 10%	60	0.252	1.10	4.40	110
- 152K	1500 ± 10%	60	0.252	0.90	6.00	100
- 182K	1800 ± 10%	60	0.252	0.80	7.00	90
- 222K	2200 ± 10%	60	0.252	0.75	8.00	80
- 272K	2700 ± 10%	60	0.252	0.70	9.00	70
- 332K	3300 ± 10%	60	0.252	0.60	12.00	60
- 392K	3900 ± 10%	60	0.252	0.55	14.00	55
- 472K	4700 ± 10%	60	0.252	0.50	16.00	50
- 562K	5600 ± 10%	60	0.252	0.48	18.00	45
- 682K	6800 ± 10%	60	0.252	0.44	24.00	40
- 822K	8200 ± 10%	60	0.252	0.40	30.00	36
- 103K	10000 ± 10%	60	0.0796	0.36	39.00	34
- 123K	12000 ± 10%	60	0.0796	0.32	46.00	32
- 153K	15000 ± 10%	60	0.0796	0.30	54.00	30
- 183K	18000 ± 10%	60	0.0796	0.28	76.00	27
- 223K	22000 ± 10%	60	0.0796	0.24	92.00	25
- 273K	27000 ± 10%	60	0.0796	0.20	102.00	22
- 333K	33000 ± 10%	60	0.0796	0.16	140.00	20
- 393K	39000 ± 10%	60	0.0796	0.13	150.00	18
- 473K	47000 ± 10%	60	0.0796	0.10	162.00	16

Packaging: 500 pieces in bags; 5,000 pieces in a box

Bourns® Leaded Inductors

RL1014 SERIES ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz)	SRF (MHz) min.	RDC (Ω) max.	IDC (mA) max
RL 1014 - 101K	100 ± 10%	45	796.0	3.20	0.85	350
- 121K	120 ± 10%	45	796.0	3.00	0.95	330
- 151K	150 ± 10%	45	796.0	2.80	1.05	310
- 181K	180 ± 10%	45	796.0	2.50	1.15	300
- 221K	220 ± 10%	40	796.0	2.10	1.30	280
- 271K	270 ± 10%	40	796.0	2.00	1.50	260
- 331K	330 ± 10%	40	796.0	1.95	1.70	240
- 391K	390 ± 10%	40	796.0	1.85	1.85	230
- 471K	470 ± 10%	35	796.0	1.55	2.30	210
- 561K	560 ± 10%	35	796.0	1.30	2.55	200
- 681K	680 ± 10%	35	796.0	1.15	2.85	190
- 821K	820 ± 10%	35	796.0	1.00	3.10	180
- 102K	1000 ± 10%	50	252.0	0.90	4.10	160
- 122K	1200 ± 10%	50	252.0	0.80	4.70	150
- 152K	1500 ± 10%	50	252.0	0.70	5.80	130
- 182K	1800 ± 10%	50	252.0	0.60	7.40	115
- 222K	2200 ± 10%	50	252.0	0.55	8.40	110
- 272K	2700 ± 10%	50	252.0	0.50	9.60	95
- 332K	3300 ± 10%	50	252.0	0.45	10.50	80
- 392K	3900 ± 10%	50	252.0	0.40	12.00	70
- 472K	4700 ± 10%	45	252.0	0.38	14.00	65
- 562K	5600 ± 10%	45	252.0	0.36	16.00	60
- 682K	6800 ± 10%	40	252.0	0.34	18.00	55
- 822K	8200 ± 10%	40	252.0	0.32	24.50	50
- 103K	10000 ± 10%	50	79.6	0.30	32.00	45
- 123K	12000 ± 10%	50	79.6	0.28	36.00	40
- 153K	15000 ± 10%	50	79.6	0.26	48.00	35
- 183K	18000 ± 10%	45	79.6	0.24	52.00	30
- 223K	22000 ± 10%	45	79.6	0.22	58.00	28
- 273K	27000 ± 10%	45	79.6	0.20	62.00	26
- 333K	33000 ± 10%	45	79.6	0.18	90.00	24
- 393K	39000 ± 10%	40	79.6	0.17	100.00	22
- 473K	47000 ± 10%	35	79.6	0.16	150.00	20
- 563K	56000 ± 10%	35	79.6	0.15	200.00	18
- 683K	68000 ± 10%	35	79.6	0.14	220.00	16
- 823K	82000 ± 10%	30	79.6	0.12	240.00	14
- 104K	100000 ± 10%	30	25.2	0.10	300.00	12

Packaging: 300 pieces in bags; 3000 pieces in a box



HIGH RATED CURRENT FIXED INDUCTORS

- Four types available
- High rated current for high current circuits

680K

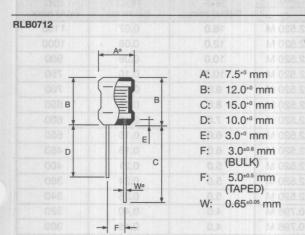
153K

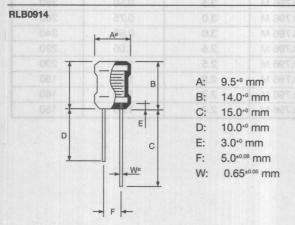
- RLB0712 and RLB0912 can be tape and reel packaged for automated assembly
- Available in E12 series

RLB0712/RLB0912/RLB0914/RLB1314 Series

Bourns® High Current Inductors

These radial lead fixed inductors are mainly used in applications for high current circuits.





PART NUMBER 09 RL B (4) (1) (2) (3) (5) (6) (1) Radial lead type (2) Tube cover Outside diameter (3) Body height Inductance Tolerance: (K: ±10%, M: ±20%) (7) Tape and reel **RLB0912** 9.5⁺⁰ mm B: 12.0⁺⁰ mm 5.0±1 mm C: 3.0⁺⁰ mm 5.0±0.8 mm (BULK) 5.0±0.5 mm (TAPED) 0.65±0.05 mm **RLB1314 3R3M** A: 13.0⁺⁰ mm B: 14.0+0 mm 470K C: 15.0±5.0 mm 3.0⁺⁰ mm per electrical W: J spec. sheet

HIGH RATED CURRENT FIXED INDUCTORS

High raised current for high current circuits

RLB0712 and RLB0912 can be tape and reel packaged for automates
assembly

RLB0712/RLB0912/RLB0914/RLB1314 Series

Bourns® High Current Inductors

RLB0712 SERIES ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance	Q	Test 1	freq. (Hz)	SRF	RDC	IDC
	(μH)	min.	L	Q	(MHz) min.	(Ω) max.	(mA) max
RLB 0712 - 100K	10 ± 10%	20	1 k	2.520 M	16.0	0.07	1100
- 120K	12 ± 10%	20	1 k	2.520 M	12.0	0.08	1000
- 150K	15 ± 10%	20	1 k	2.520 M	10.0	0.09	900
- 180K	18 ± 10%	20	1 k	2.520 M	10.0	0.10	750
- 220K	22 ± 10%	20	1 k	2.520 M	9.0	0.12	700
- 270K	27 ± 10%	20	1 k	2.520 M	8.0	0.13	650
- 330K	33 ± 10%	20	1 k	2.520 M	7.0	0.15	600
- 390K	39 ± 10%	20	1 k	2.520 M	6.0	0.16	550
- 470K	47 ± 10%	20	1 k	2.520 M	6.0	0.18	450
- 560K	56 ± 10%	20	1 k	2.520 M	5.0	0.21	400
- 680K	68 ± 10%	20	1 k	2.520 M	5.0	0.24	360
- 820K	82 ± 10%	20	1 k	2.520 M	5.0	0.35	340
- 101K	100 ± 10%	20	1 k	0.796 M	4.0	0.40	320
- 121K	120 ± 10%	20	1 k	0.796 M	4.0	0.45	300
- 151K	150 ± 10%	20	1 k	0.796 M	3.5	0.50	280
- 181K	180 ± 10%	20	1 k	0.796 M	3.0	0.75	260
- 221K	220 ± 10%	20	1 k	0.796 M	3.0	0.90	240
- 271K	270 ± 10%	20	1 k	0.796 M	2.5	1.00	220
- 331K	330 ± 10%	20	1 k	0.796 M	2.5	1.10	200
- 391K	390 ± 10%	20	1 k	0.796 M	2.0	1.20	180
- 471K	470 ± 10%	20	1 k	0.796 M	2.0	1.50	160
- 561K	560 ± 10%	20	1 k	0.796 M	2.0	1.80	150

Packaging: 500 pieces in bags; available in ammo pack - 1,000 pieces per box

MATERIALS

Core: Ferrite DR core
Wire: Enameled copper wire
Lead: Tinned copper wire for bulk
Lead: Tinned CP wire for tape
Tube Shrinkable tube 125°C, 600V
Temperature
Rise: 20°C max. at rated current

RLB0712/RLB0912/RLB0914/RLB1314 Series

Bourns® High Current Inductors

RLB0912 SERIES ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance	Q	Test	req. (Hz)	SRF	RDC	IDC
	(µH)	min.	L	Q	(MHz) min.	(Ω) max.	(A) max
RLB 0912 - 1R5M	1.5 ± 20%	30	1 k	7.960 M	78.0	0.008	5.4
- 2R2M	2.2 ± 20%	30	1 k	7.960 M	63.0	0.010	4.5
- 3R3M	3.3 ± 20%	30	1 k	7.960 M	50.0	0.018	3.6
- 4R7M	4.7 ± 20%	30	1 k	7.960 M	41.0	0.022	3.1
- 6R8M	6.8 ± 20%	30	1 k	7.960 M	33.0	0.028	2.5
- 100K	10.0 ± 10%	60	1 k	2.520 M	27.0	0.043	2.1
- 150K	15.0 ± 10%	50	1 k	2.520 M	21.0	0.056	1.7
- 220K	22.0 ± 10%	50	1 k	2.520 M	17.0	0.086	1.4
- 330K	33.0 ± 10%	45	1 k	2.520 M	13.0	0.140	1.1
- 470K	47.0 ± 10%	40	1 k	2.520 M	11.0	0.170	0.96
- 680K	68.0 ± 10%	35	1 k	2.520 M	9.0	0.280	0.79
- 101K	100.0 ± 10%	55	1 k	0.796 M	7.2	0.330	0.66
- 151K	150.0 ± 10%	40	1 k	0.796 M	5.7	0.560	0.53
- 221K	220.0 ± 10%	30	1 k	0.796 M	4.5	0.720	0.44
- 331K	330.0 ± 10%	25	1 k	0.796 M	3.6	1.100	0.36
- 471K	470.0 ± 10%	25	1 k	0.796 M	2.9	1.700	0.30
- 681K	680.0 ± 10%	25	1 k	0.796 M	2.3	2.300	0.25
- 102K	1000.0 ± 10%	55	1 k	0.252 M	1.9	4.300	0.20

Packaging: 500 pieces per bag; available on tape and reel - 500 pieces per reel

MATERIALS

Core: Ferrite DR core

Wire: Enameled copper wire

Lead: Tinned copper wire for bulk

Lead: Tinned CP wire for tape

Tube Shrinkable tube 125°C, 600V

Temperature

Rise: 20°C max. at rated current

RLB0712/RLB0912/RLB0914/RLB1314 Series

Bourns® High Current Inductors

RLB0914 SERIES ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance (µH)	Q min.	Test freq. (MHz) L Q	SRF (MHz) min.	RDC (Ω) max.	IDC (A) max
RLB 0914 - 3R3M	3.3 ± 20%	20	7.960	70.0	0.027	3.60
- 4R7M	4.7 ± 20%	20	7.960	50.0	0.033	3.20
- 6R8M	6.8 ± 20%	20	7.960	30.0	0.039	3.00
- 100K	10.0 ± 10%	50	2.520	20.0	0.048	2.70
- 120K	12.0 ± 10%	50	2.520	15.0	0.055	2.50
- 150K	15.0 ± 10%	50	2.520	10.0	0.060	2.40
- 180K	18.0 ± 10%	40	2.520	9.5	0.065	2.30
- 220K	22.0 ± 10%	40	2.520	9.0	0.090	1.90
- 270K	27.0 ± 10%	40	2.520	8.5	0.110	1.80
- 330K	33.0 ± 10%	40	2.520	8.0	0.120	1.70
- 390K	39.0 ± 10%	30	2.520	7.0	0.130	1.60
- 470K	47.0 ± 10%	30	2.520	6.0	0.140	1.50
- 560K	56.0 ± 10%	30	2.520	5.0	0.200	1.30
- 680K	68.0 ± 10%	30	2.520	4.5	0.210	1.20
- 820K	82.0 ± 10%	30	2.520	4.0	0.230	1.10
- 101K	100.0 ± 10%	30	0.796	3.5	0.280	1.00
- 121K	120.0 ± 10%	30	0.796	3.0	0.320	0.90
- 151K	150.0 ± 10%	30	0.796	2.8	0.370	0.80
- 181K	180.0 ± 10%	30	0.796	2.6	0.540	0.75
- 221K	220.0 ± 10%	20	0.796	2.4	0.600	0.70
- 271K	270.0 ± 10%	20	0.796	2.2	0.680	0.65
- 331K	330.0 ± 10%	20	0.796	2.0	0.760	0.60
- 391K	390.0 ± 10%	20	0.796	1.9	0.850	0.55
- 471K	470.0 ± 10%	20	0.796	1.8	1.300	0.50
- 561K	560.0 ± 10%	20	0.796	1.7	1.400	045
- 681K	680.0 ± 10%	20	0.796	1.6	1.600	0.40
- 821K	820.0 ± 10%	20	0.796	1.5	1.800	0.35
- 102K	1000.0 ± 10%	40	0.252	1.3	2.100	0.30

Packaging: 500 pieces in bags; 5,000 pieces per box

MATERIALS

Core:Ferrite DR core

Wire:Enameled copper wire

Lead:Tinned copper wire

TubeShrinkable tube 125°C, 600V

Temperature

Rise:.....40°C max. at rated current

RLB0712/RLB0912/RLB0914/RLB1314 Series

Bourns® High Current Inductors

RLB1314 SERIES ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance	0	Test f	req. (Hz)	SRF	RDC	IDC	W Dia.	F
	(µH)	Ref.	L	Q	(MHz) Typ.	(Ω) max.	(A) max.	mm ±0.05	mm ±1.0
RLB 1314 - 3R3M	3.3 ± 20%	90	1 k	7.96 M	59.00	0.008	5.600	0.8	10.0
- 4R7M	4.7 ± 20%	100	1 k	7.96 M	45.00	0.009	4.700	0.8	10.0
- 6R8M	6.8 ± 20%	80	1 k	7.96 M	34.00	0.012	3.900	0.7	10.0
- 100M	10.0 ± 20%	140	0 1 k	2.52 M	26.00	0.015	3.200	0.7	10.0
- 150M	15.0 ± 20%	120	1 k	2.52 M	19.00	0.019	2.600	0.7	10.0
- 220K	22.0 ± 10%	110	1 k	2.52 M	14.00	0.026	2.200	0.7	10.0
- 330K	33.0 ± 10%	100	1 k	2.52 M	10.00	0.045	1.800	0.6	10.0
- 470K	47.0 ± 10%	90	1 k	2.52 M	8.30	0.056	1.500	0.6	10.0
- 680K	68.0 ± 10%	80	1k	2.52 M	6.70	0.092	1.200	0.8	7.0
- 101K	100.0 ± 10%	70	1 k	796 K	5.40	0.120	1.000	0.8	7.0
- 151K	150.0 ± 10%	70	1 k	796 K	4.30	0.200	0.820	0.8	7.0
- 221K	220.0 ± 10%	40	1 k	796 K	3.40	0.250	0.680	0.8	7.0
- 331K	330.0 ± 10%	40	1 k	796 K	2.70	0.420	0.550	0.8	7.0
- 471K	470.0 ± 10%	30	1 k	796 K	2.30	0.510	0.460	0.8	7.0
- 681K	680.0 ± 10%	30	1 k	796 K	1.90	0.790	0.380	0.8	7.0
- 102K	1000.0 ± 10%	40 .	1 k	252 K	1.60	1.300	0.310	0.8	7.0
- 152K	1500.0 ± 10%	30	1k	252 K	1.30	1.700	0.250	0.8	7.0
- 222K	2200.0 ± 10%	60	1 k	252 K	1.10	2.900	0.210	0.8	7.0
- 332K	3300.0 ± 10%	50	1k	252 K	0.90	3.700	0.170	0.8	7.0
- 472K	4700.0 ± 10%	50	1 k	252 K	0.76	5.600	0.140	0.8	7.0
- 682K	6800.0 ± 10%	60	1 k	252 K	0.65	9.400	0.120	0.8	7.0
- 103K	10000.0 ± 10%	80	1 k	79.6 K	0.53	12.000	0.100	0.8	7.0
- 153K	15000.0 ± 10%	70	1 k	79.6 K	0.41	15.000	0.082	0.8	7.0

Packaging: 300 pieces in bags; 3,000 pieces per box

MATERIALS

Core:Ferrite DR core
Wire:Enameled copper wire

Lead:0.6 dia. - 0.8 dia. mm soldered copper wire (3.3μH - 47 μH)

Lead:0.8 dia. mm tinned copper wire (68 μH - 15 μH)

TubeShrinkable tube 125°C, 600V

Temperature

Rise:.....20°C max. at rated current

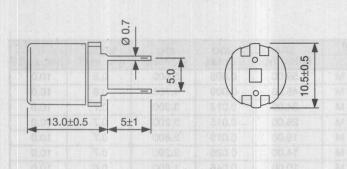


SHIELDED FIXED INDUCTORS

- High inductance up to 47mH
- High Q level

FSR1013 Series

Bourns® Shielded Inductors



PART NUMBER

<u>F</u> <u>S</u> <u>R</u> <u>10</u> <u>13</u> - <u>102</u> <u>K</u> (1) (2) (3) (4) (5) (6) (7)

(1) Fixed inductor

(2) Shielded

(3) Radial type

(4) Outside Dia.: 10.5±0.5 mm

(5) Body height: 13.0±0.5 mm

(6) Inductance: 1.0 mH

(7) Tolerance: ±10%

ELECTRICAL CHARACTERISTICS

BOURNS Part No.	Inductance	Q	Test 1	req. (Hz)	SRF	RDC	Rated Curr	
	(mH)	min.	L	Q	(kHz) min.	(Ω) max.	IDC (mA)	
FSR 1013 - 102K	1.0 ± 10%	40	1 k	252.0 k	740	4.0	150	
- 122K	1.2 ± 10%	40	1 k	252.0 k	670	5.0	140	
- 152K	1.5 ± 10%	40	1 k	252.0 k	500	6.0	130	
- 182K	1.8 ± 10%	40	1 k	252.0 k	480	7.0	115	
- 222K	2.2 ± 10%	40	1 k	252.0 k	410	10.0	100	
- 272K	2.7 ± 10%	40	1 k	252.0 k	390	11.0	95	
- 332K	3.3 ± 10%	30	1 k	252.0 k	350	12.0	85	
- 392K	3.9 ± 10%	30	1 k	252.0 k	340	13.0	80	
- 472K	4.7 ± 10%	30	1 k	252.0 k	320	23.0	70	
- 562K	5.6 ± 10%	30	1 k	252.0 k	310	25.0	65	
- 682K	6.8 ± 10%	20	1 k	252.0 k	280	30.0	60	
- 822K	8.2 ± 10%	20	1 k	252.0 k	260	32.0	50	
- 103K	10.0 ± 10%	50	1 k	79.6 k	240	35.0	45	
- 123K	12.0 ± 10%	50	1 k	79.6 k	210	50.0	40	
- 153K	15.0 ± 10%	50	1 k	79.6 k	190	58.0	38	
- 183K	18.0 ± 10%	50	1 k	79.6 k	180	63.0	35	
- 223K	22.0 ± 10%	40	1 k	79.6 k	140	90.0	30	
- 273K	27.0 ± 10%	40	1 k	79.6 k	130	100.0	28	
- 333K	33.0 ± 10%	40	1 k	79.6 k	125	115.0	25	
- 393K	39.0 ± 10%	30	1 k	79.6 k	120	185.0	23	
- 473K	47.0 ± 10%	30	1 k	79.6 k	110	205.0	22	

MATERIALS

Core:Ferrite POT core
Wire:Enamelled copper wire

Bobbin:Phenolic Adhesive:Epoxy resin

Temperature

Rise:.....40°C max. at rated current



THICK FILM CHIP RESISTOR ARRAYS

- Convex and concave terminals
- 2, 4 and 8 elements available
- Resistance tolerance 5% and 1%
- E12 series from 10 ohms to 1 megohm

CAT/CAY Series

Bourns® Chip Resistor Arrays

Available 3rd Quarter '95

SPECIFICATIONS

Requirement	Characteristics	Test Method		
Short Time Overload ±1%		Rated Voltage X 2.5, 5 seconds		
Soldering Heat	±1%	260°C ±5°C, 10 seconds ±1 second		
Temperature Cycling (5)	±1%	125°C (30 minutes) - normal (15 minutes) -30°C (30 minutes) - normal (15 minutes)		
Moisture Load Life	±2%	1000 hours		
Load Life	±2%	1000 hours		

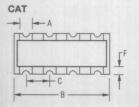
CHARACTERISTICS

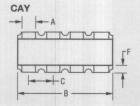
Characteristics	CAT16/CAY16	CAT20	CAT32
Number of Elements	2,4,8	4	4
Power Rating	62mW	100mW	125mW
Resistance Tolerance	5%, 1%	5%	5%
Resistance Range E12		10 ohms - 1 megohm	
T.C.R.	Attended Subjects	±200ppm/°C	
Max. Working Voltage	50V	100V	200V
Operating Temp. Range	DIESC STANCE	-55°C - 125°C	labet/
Rating Temperature		+70°C	200.0

DIMENSIONS (MM)

Model	Number Of Elements	A	В	С	D	E (0	.0.85 m F 6.050.0
CAT16 CAY16	2 4* 8	0.5±0.15	1.6±0.2 3.2±0.2 6.4±0.2	0.8±0.05	1.6±0.2	0.5±0.1	0.3±0.15
CAT20	4	0.9±0.15	5.1±0.3	1.27±0.05	2.0±0.2	0.6±0.1	0.4±0.2
CAT32	4	0.9±0.15	5.1±0.3	1.27±0.05	3.2±0.2	0.6±0.1	0.5±015

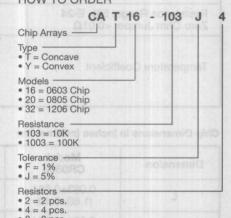
*5% preferred, 1% available







HOW TO ORDER



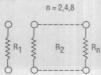
• 8 = 8 pcs.

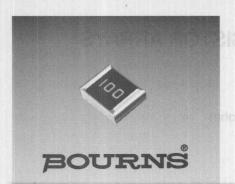
TAPE AND REE	L PACK	AGING			
Model	Pieces per Re				
Number	2r	4r	8r		

Number	2r	4r	8r
CAT16*/CAY16*	5,000	5,000	4,000
CAT20		4,000	
CAT32		2,000	

*PLASTIC REEL WITH PAPER TAPE

SCHEMATIC





THICK FILM CHIP RESISTORS

- Very high quality and stability
- Power rating at 70°C: CR0603 0.10W, CR0805 0.125W,
 CR1206 0.25W
- Three layer contacting process with nickel barrier prevents leaching and provides excellent solderability
- Tight tolerances of bottom electrode width
- Suitable for all types of soldering processes

Models CR0603/CR0805/CR1206

Bourns® Chip Resistors

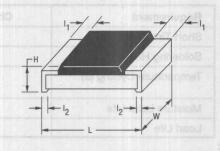
Electrical Characteristics

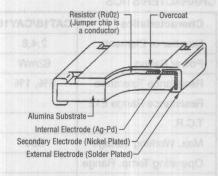
Characteristic	Model CR0603	Model CR0805	Model CR1206		
Power Rating @ 70°C	1/10W	1/8W	1/4W		
Operating *emperature Range	apaurim 36) O as	-55°C to +125°C	300		
Derated to 0 Load at	30° C (30 minutes	+125°C			
Maximum Working Voltage	50V	150V	200V		
Maximum Overload Voltage	100V 300V 400V				
Resistance Range: 1%, E-96	10Ω-1ΜΩ				
Resistance Range: 5%, E-24 Zero Ohm Jumper <0.01Ω	9	1Ω-10ΜΩ	OSTAO		
Temperature Coefficient	o V	cial value on req 1%: ±100ppm/°0 5%: ±200ppm/°C : -200ppm/°C to	Wmoot		

Chip Dimensions in Inches (millimeters)

Dimension	Model	Model	Model
	CR0603	CR0805	CR1206
L	0.063±0.004	0.079±0.006	0.126±0.006
	(1.60±0.10)	(2.00±0.15)	(3.20±0.15)
W	0.031±0.004	0.049±0.004	0.063±0.006
	(0.80±0.10)	(1.25±0.10)	(1.60±0.15)
HAIDANDA	0.018±0.004	0.020±0.004	0.024±0.004
	(0.45±0.10)	(0.50±0.10)	(0.60±0.10)
0.012±0.008		0.016±0.008	0.020±0.010
(0.30±0.20)		(0.40±0.20)	(0.50±0.25)
12	0.012±0.008	0.016±0.008	0.020±0.010
	(0.30±0.20)	(0.40±0.20)	(0.50±0.25)

Dimensional Drawings





Models CR0603/CR0805/CR1206

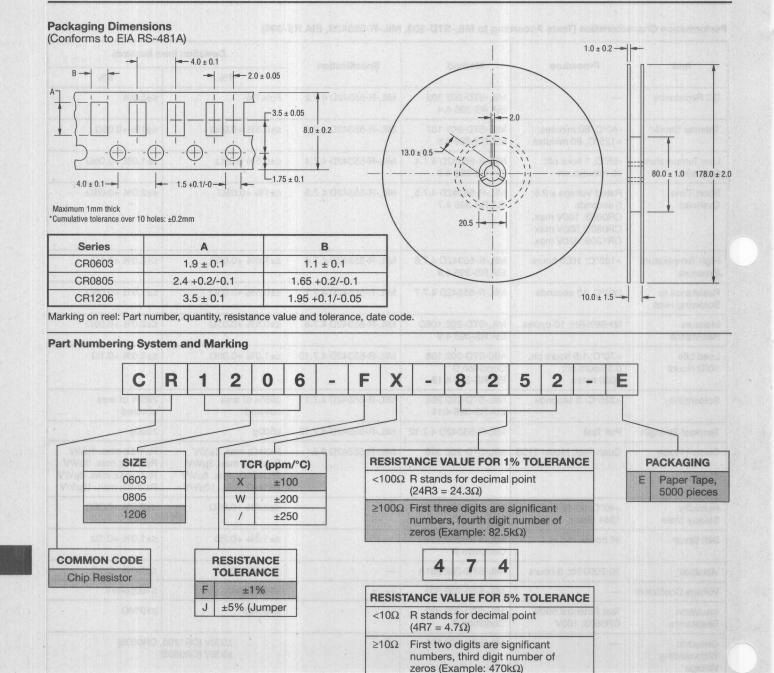
Bourns® Chip Resistors

Performance Characteristics (Tests According to MIL-STD-202, MIL-R-55342B, EIA RS-396)

		Decadure Mathed Consideration		Deviation from Nominal			
Test	Procedure	Method	Specification	1%	5%		
DC Resistance	Resistance — MIL-STD-202 303 EIA RS-396 4.4		MIL-R-55342D 4.7.2	F:≤±1%	≤±5.0%		
Thermal Shock	-40°C, 60 minutes; +125°C, 60 minutes	MIL-STD-202 107 EIA RS-396 4.5	MIL-R-55342D 4.7.3	≤±0.5% +0.05Ω	≤±1% +0.05Ω		
Low Temperature Operation	-55°C, 1 hour off; 45 minutes on	MIL-R-55342D 4.7.4 EIA RS-396 4.6	MIL-R-55342D 4.7.4	≤±0.5% 0.05Ω	≤±1.0% +0.05Ω		
Short Time Overload Rated Voltage x 2.5; 5 seconds CR0603: 100V max. CR0805; 300V max. CR1206: 400V max.		MIL-R-55342D 4.7.5 EIA RS-396 4.7	MIL-R-55342D 4.7.5	≤±1% +0.05Ω	≤±2.0% +0.05Ω		
High Temperature Exposure	+125°C; 1000 hours	MIL-R-55342D 4.7.6 EIA RS-396 4.8	MIL-R-55342D 4.7.6	≤±1.0% +0.05Ω	≤+2.0% +0.1Ω		
Resistance to Soldering Heat	260°C, 10 seconds	MIL-R-55342D 4.7.7	MIL-R-55342D 4.7.7	≤±0.5% +0.05Ω	≤±1.0% +0.05Ω		
Moisture 90-98%RH; 10 cycles Resistance		90-98%RH; 10 cycles MIL-STD-202 106D EIA RS-396 4.9		≤±0.5% +0.05Ω	≤±2.0% +0.05Ω		
Load Life +70°C; 1.5 hours on, 0.5 hours off; 1000 hours		MIL-STD-202 108 Condition D EIA RS-396 4.12	MIL-R-55342D 4.7.10	≤±1.0% +0.05Ω	≤±3.0% +0.1Ω		
Solderability +235°C; 3 seconds		MIL-STD-202 208 EIA RS-396 4.11	MIL-R-55342D 4.7.11	≥95% of area covered	≥95% of area covered		
Terminal Strength	Pull Test	MIL-R-55342D 4.7.12	MIL-R-55342D 4.7.12	≥500g	≥500g		
Current Noise	Quan-Tech Model 315B	MIL-STD-202 308	MIL-R-55342D 6.6	R≤1k Ω ; max. 1 μ V/V R≤10k Ω ; max. 3 μ V/V R≤100k Ω ; max. 6 μ V/V R≤1M Ω ; max. 10 μ V/V	R≤1k Ω ; max. 1 μ V/V R≤10k Ω ; max. 3 μ V/V R≤100k Ω ; max. 6 μ V/V R≤2M Ω ; max. 10 μ V/V		
Humidity, Steady State	+40°C; 90-95% RH, 1344 Hours	MIL-STD-202 103B Condition D	7	≤±2.5% +0.05Ω	≤±2.5% +0.05Ω		
Salt Spray	96 hours	MIL-STD-202 101D Condition A	_	≤±1.0% +0.2Ω	≤±1.0% +0.1Ω		
Vibration	10-2000 Hz, 6 hours	MIL-STD-202 201A		≤±0.5% +0.1Ω	≤±1.0% +0.1Ω		
Voltage Coefficient	- A Ballacer Ing S	MIL-STD-202 309		≤100ppm/V	≤100ppm/V		
Insulation Resistance	Test Potential 500V CR0603: 100V	MIL-STD-202 302 Condition B		≥10³MΩ	≥10 ³ MΩ		
Dielectric Withstanding Voltage	maching to redinu	MIL-STD-202 301	-18	≥500V (CR120 ≥300V (CR060			
Drop Test	1m	MIL-STD-202 203B		≤±0.5% +0.1Ω	≤±1.0% +0.1Ω		
Bending Test	5mm/90mm; 10 sec.			≤±1% +0.05Ω	≤±1.0% +0.05Ω		

Models CR0603/CR0805/CR1206

Bourns® Chip Resistors



0

0

0

Jumper

Models CR0603/CR0805/CR1206

Bourns® Chip Resistors

CR0603 CR0805 CR1206



5% marking Value = 10KΩ

CR0805 CR1206



1% marking Value = $10K\Omega$

CR0603 EIA-96 Marking



1% marking Value = $12.4K\Omega$

Marking Explanation

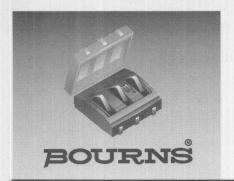
- 5% tolerance: 3 digits, first two digits are significant, third digit is number of zeros.
 Letter R is decimal point.
- 1% tolerance: 4 digits, first three digits are significant, fourth digit is number of zeros. Letter R is decimal point.
- 0603 1%: EIA-96 marking

EIA-96 Marking for CR0603, 1%

Code	R Value														
01	100	13	133	25	178	37	237	49	316	61	422	73	562	85	750
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	604	88	806
05	110	17	147	29	196	41	261	53	348	65	464	77	619	89	825
06	113	18	150	30	200	42	267	54	357	66	475	78	634	90	845
07	115	19	154	31	205	43	274	55	365	67	487	79	649	91	866
08	118	20	158	32	210	44	280	56	374	68	499	80	665	92	887
09	121	21	162	33	215	45	287	57	383	69	511	81	681	93	909
10	124	22	165	34	221	46	294	58	392	70	523	82	698	94	931
11	127	23	169	35	226	47	301	59	402	71	536	83	715	95	953
12	130	24	174	36	232	48	309	60	412	72	549	84	732	96	976

This table shows the first two digits for the three-digit EIA-96 part marking scheme. The third character is a letter multiplier: $S=10^{\circ}$ $R=10^{\circ}$ $R=10^{\circ}$

Lab-Kit: CR1206-JW-LAB1 1206 Style, ±5%, ±200ppm/°C, E24	50 pcs. each:	1Ω - 10Ω: 10Ω - 1ΜΩ: 1ΜΩ - 10ΜΩ:	E12 E24 E12	Lab-Kit: CR1206-FX-LAB4 1206 Style, ±1%, ±100ppm/°C, E48	50 pcs. each:	10Ω - 1MΩ: Every other val Jumper	E48 lue
Lab-Kit: CR0805-JW-LAB2 0805 Style, ±5%, ±200ppm/°C, E24	50 pcs. each:	24Ω - 1MΩ: Jumper	E24	Lab-Kit: CR0805-FX-LAB5 0805 Style, ±1%, ±100ppm/°C, E24	50 pcs. each:	75Ω - 1MΩ: Jumper	E24
Lab-Kit: CR1206-FX-LAB3 1206 Style, ±1%, ±100ppm/°C, E24	50 pcs. each:	10Ω - 1MΩ: Jumper	E24	Lab-Kit: CR0603-JW-LAB6 0603 Style, ±5%, ±200ppm/°C, E24	50 pcs. each:	3.3Ω - 10Ω : 10Ω - $1M\Omega$: Jumper	E12 E24



MODULAR CONTACT - MALE

- Rechargeable battery-pack applications
- 2 through 6 contacts
- Precious metal contacts
- Various contact forces and heights
- Surface mount or through-hole
- Pick and place compatible
- IR and vapor phase compatible

Model 70AD/M

Bourns® Modular Contact

TESTS PER MIL-STD-1344A

Electrical Characteristics

Environmental Characteristics

Insulation Resistance.....Method 3003.1 > 10,000 megohms

Humidity
.....Method 1002.2, 3003.1, 3004.1
Insulation Resistance

......> 10,000 megohms Δ Contact Resistance< 0.003 ohms* Operating Temperature

After 10,000 Matings
Δ Contact Resistance< 0.003 ohms*
PlatingPladium-nickel, gold
Standard Packaging50 pcs. per tube

*with optional contact mate

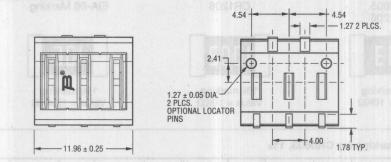
HOW TO ORDER 70AD J - 003 - M L 0 Model Terminal Style J = SMT H = Through-hole Number of Contacts 002 through 006 Gender M = Male F = Female Height L = Low Profile Options 0 = Standard 1 = Locator Pins

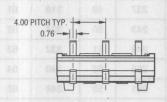
*Available options as shown above. Contact factory for spec drawings.

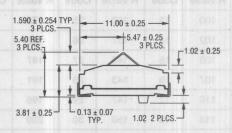
DIMENSIONS ARE IN MILLIMETERS.

TOLERANCES ARE ±0.30 UNLESS OTHERWISE SPECIFIED.

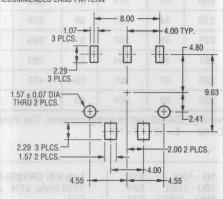
Model 70AD Male

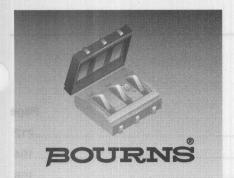






RECOMMENDED LAND PATTERN





MODULAR CONTACT - FEMALE

- Rechargeable battery-pack applications
- Precious metal contacts
- Surface mount or through-hole
- Pick and place compatible
- IR and vapor phase compatible

Model 70AD/F

Bourns® Modular Contact

TESTS PER MIL-STD-1344A

Electrical Characteristics

Rating	3 amps continuous
Contact Resistance	Method 3004.1
@ 25°C	< 0.025 ohms*
Dielectric Withstanding	Voltage
Method 3001.1	> 500Vrms

Environmental Characteristics

Insulation Resistance......Method 3003.1 > 10,000 megohms

Humidity

.....Method 1002.2, 3003.1, 3004.1 Insulation Resistance

.....> 10,000 megohms △ Contact Resistance< 0.003 ohms* **Operating Temperature**

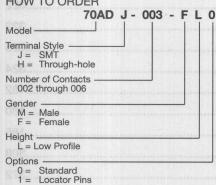
.....-55°C to +125°C

Durability......Method 2016 After 10,000 Matings △ Contact Resistance< 0.003 ohms*

PlatingPaladium-nickel, gold Standard Packaging50 pcs. per tube

*with optional contact mate †contact factory for additional pin configurations

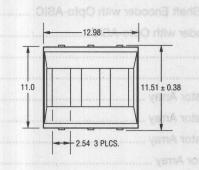
HOW TO ORDER

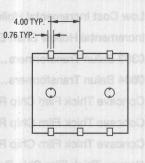


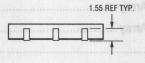
DIMENSIONS ARE IN MILLIMETERS.

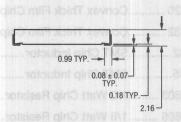
TOLERANCES ARE ±0.30 UNLESS OTHERWISE SPECIFIED.

Model 70AD Female (Optional)*

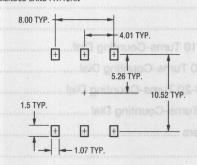








RECOMMENDED LAND PATTERN



*CONTACT FACTORY FOR ADDITIONAL PIN FIGURATIONS

BOURNS

Model	Description eldisemon eosig one xiol9 w	Page
BA 58	Absolute Shaft Encoder, 10-24 Bit	212
BI 30	Incremental Shaft Encoder with Opto-ASIC	194
BI 31	Incremental Shaft Encoder with Opto-ASIC	188
BI 32	Incremental Shaft Encoder with Opto-ASIC	190
BI 36	Incremental Shaft Encoder with Opto-ASIC	197
BI 39	Incremental Shaft Encoder with Opto-ASIC	192
BI 58	Incremental Shaft Encoder with Opto-ASIC	201
BI 58-D	Low Cost Incremental Hollow Shaft Encoder with Opto-ASIC	206
BI 58-H	Incremental Hollow Shaft Encoder with Opto-ASIC	209
	0303 Balun Transformers	
	0604 Balun Transformers	345
CAT 16	Concave Thick Film Chip Resistor Array	373
CAT 20	Concave Thick Film Chip Resistor Array	373
CAT 32	Concave Thick Film Chip Resistor Array	373
	Convex Thick Film Chip Resistor Array	
CAY 20	Convex Thick Film Chip Resistor Array	373
CAY 32	Convex Thick Film Chip Resistor Array	373
CM 32	SMT Chip Inductor	351
CM 45	SMT Chip Inductor	351
CR 0603 .	1/0 Watt Chip Resistor	374
	1/8 Watt Chip Resistor	
CR 1206 .	1/4 Watt Chip Resistor	374
CT-23	1-1/16" (27mm) Digital 0-10 Turns-Counting Dial	322
CT-26	1-1/8" (28mm) Digital 0-10 Turns-Counting Dial	322
CT-46	1-13/16" (46mm) Digital 0-20 Turns-Counting Dial	325
CT-50	7/8" (22mm) Digital 0-10 Turns-Counting Dial	324
EC	Digital Contacting Encoders	182
EN	Rotary Optical Encoders	180
ESD	Shaftless Contacting Encoder	185
DSS100	Digital Sapphire Pressure Sensor	308
FSR1013.	Shielded Inductors	372
H-22	22mm Digital 0-15 Turns-Counting Dial	330
H-25	Trimmer Stacking Strap	66
H-26	Trimmer Side Bracket	66
H-28	Trimmer Stacking Strap	66
H-385	Protector for Pushbutton Potentiometer	295
H-46	46mm Digital 0-20 Turns-Counting Dial	326
H-58P	1-1/4" (32mm) Rectangular Trimmer Panel Mount	64
H-65P	1/2" (12.7mm) Square Panel Mount	64



Model	Description	Page
H-82	Trimmer Panel Seal	64
H-83P	Trimmer Panel Mount	64
H-114P	3/8" (9.53mm) Square Trimmer Panel Mount	65
H-115P	3/8" (9.53mm) Square Trimmer Panel Mount	65
	3/8" (9.53mm) Square Trimmer Panel Mount	
H-490	25mm 0-30 Turns Counting Dial	327
H-506	22mm 0-15 Turns Counting Dial	338
H507-6	22mm 0-15 Turns Counting Dial	329
H-800	Trimmer Lab Design Kit (Trim-Bin)	73
H-814	SMT Trimmer Lab Design Kit	73
LM-LP-10	00Sealed/Leaded Telephone Line Matching Transformers	333
LM-NP-10	00Sealed/Leaded Telephone Line Matching Transformers	333
	Open Frame/Leaded Telephone Line Matching Transformers	
MD-50	28mm 0-10 Turns Counting Dial	323
PC	Low Cost Conductive Plastic Slimline Potentiometer	262
RF2	Wideband RF Transformers	339
RF3	Wideband RF Transformers	339
RF4	Wideband RF Transformers	339
RJ12	1-1/4" (32mm) Military Grade Trimmer	halina (h. 17-14- hama) (h. 18-14-14-14-14-14-14-14-14-14-14-14-14-14-
RJ22	1/2" (12.7mm) Military Grade Trimmer	17
RJ24	3/4" (19.05mm) Military Grade Trimmer	22
RJ26	1/4" (6.35mm) Military Grade Trimmer	
RJ50	1/4" (6.35mm) Military Grade Trimmer	44
RJR24	3/4" (19.05mm) High-Rel Military Grade Trimmer	23
RJR26	1/4" (6.35mm) High-Rel Military Grade Trimmer	19
RJR50	1/4" (6.35mm) High-Rel Military Grade Trimmer	44
RL0608	Leaded Inductor	362
RL0812	Leaded Inductor	
RL1014	Leaded Inductor	362
RLB0712	High Current Inductor	367
RLB0912	High Current Inductor	367
RLB0914	High Current Inductor	367
RLB1314	High Current Inductor	367
RT12	1-1/4" (32mm) Military Grade Trimmer	10
RT22	1/2 " (12.7mm) Military Grade Trimmer	16
RT24	3/8" (9.53mm) Military Grade Trimmer	21
RT26	1/4" (6.35mm) Military Grade Trimmer	18
RTR22	1/2" (12.7mm) High-Rel Military Grade Trimmer	16
RTR24	3/8" (9.53mm) High-Rel Military Grade Trimmer	enditis semissio (mand it shift)



Model	Description notignous G	Page
SD	Dual Section Low Profile Open Frame Slide Potentiometer	259
SDR0805.	SMT Power Inductor	357
SDR0906.	SMT Power Inductor	360
SDR1006.	SMT Power Inductor	358
SM-LP-500	01SMT Subminiature Telephone Line Matching Transformer	337
	02Ultra-low Profile SMT Telephone Line Matching Transformer	
	Single Section Low Profile Open Frame Slide Potentiometer	
	High Accuracy Millivolt Sapphire Sensor	
ST3110	High Temperature Sapphire Sensor	311
ST3130	High Accuracy 4-20mA Sapphire Sensor	312
ST3140	High Accuracy Amplified Sapphire Sensor	313
ST3200	High Pressure Millivolt Sapphire Sensor	314
ST3210	High Temperature Sapphire Sensor	315
ST3230	High Pressure 4-20mA Sapphire Sensor	316
ST3240	High Accuracy Amplified Sapphire Sensor	317
ST3300	High Temperature Melt Sensor	318
ST3400	Downhole Sapphire Sensor	319
ST5020	Explosion Proof Sapphire Sensor	320
20	SIP Cermet 15-Turn Sealed Trimmer	58
39	1/2" (13mm) Sealed Rotary and Push Button Switch/Potentiometer	237
51	1/2" (12.5mm) Cermet or Conductive Plastic Single-Turn Sealed Panel Control (.100" centers)	239
52	1/2" (12.5mm) Cermet or Conductive Plastic Single-Turn Panel Control (.200" centers)	239
53	1/2" (12.5mm) Cermet or Conductive Plastic Single-Turn Panel Control (Solder Lugs)	239
70AD	Modular Contacts	378
81	5/8" (16mm) Cermet or Conductive Plastic Single-Turn PC Pin Style Panel Control	242
82	5/8" (16mm) Cermet or Conductive Plastic Single-Turn J-Hook Style Panel Control	242
81/82	5/8" (16mm) Single-Turn Modular Variable Attenuator	254
83	5/8" (16mm) Wirewound 10-Turn PC Pin Style Precision Panel Control	243
84	5/8" (16mm) Hybritron® 10-Turn Solder Lug Style Precision Panel Control	243
85	5/8" (16mm) Cermet or Conductive Plastic Single-Turn PC Pin Style Panel Control with Switch	245
86	5/8" (16mm) Cermet or Conductive Plastic Single-Turn J-Hook Style Panel Control with Switch	245
87	5/8" (16mm) Cermet or Conductive Plastic Single-Turn PC Pin Style Semi-Precision Panel Control	246
88	5/8" (16mm) Cermet or Conductive Plastic Single-Turn J-Hook Style Semi-Precision Panel Control	246
91	5/8" (16mm) Cermet or Conductive Plastic Single-Turn In-Line PC Pin Style Panel Control	250
92	5/8" (16mm) Cermet or Conductive Plastic Single-Turn J-Hook Style Panel Control	250
91/92	5/8" (16mm) Single-Turn Modular Variable Attenuator	254
93	5/8" (16mm) Cermet or Conductive Plastic Single-Turn L-Pattern PC Pin Style Panel Control	250
94	5/8" (16mm) Cermet or Conductive Plastic Single-Turn L-Pattern J-Hook Style Panel Control	250
95	5/8" (16mm) Cermet or Conductive Plastic Single-Turn Triangle Pattern Solder Lug Style Panel Control	250



Model	Description polity to the poli	Page
96	5/8" (16mm) Cermet or Conductive Plastic Single-Turn Sealed In-Line PC Pin Style Panel Control	250
97	5/8" (16mm) Cermet or Conductive Plastic Single-Turn L-Pattern PC Pin Style Panel Control with Switc	h251
98	5/8" (16mm) Cermet or Conductive Plastic Single-Turn L-Pattern J-Hook Style Panel Control with Switch	h251
99	5/8" (16mm) Cermet or Conductive Plastic Single-Turn Triangle Pattern Solder Lug Style Panel Control	
Oi	w/ Switch	251
601	T-Filters (EMI/RFI Low Pass Filter) Resistor Networks	116
700	RC Terminator Resistor Networks	118
800	ECL Terminator Circuits - Capacitor Networks	120
900	Capacitor Networks	123
3005	3/4" (19.05mm) Wirewound 20-Turn Sealed Trimmer	58
	3/4" (19.05mm) Cermet 15-Turn Sealed Trimmer	
3009	3/4" (19.05mm) Cermet 15-Turn Sealed Trimmer	58
	Linear Motion Potentiometer	
3057	1-1/4" (32mm) Wirewound 22-Turn Sealed Trimmer	10
3059	1-1/4" (32mm) Cermet 22-Turn Sealed Trimmer	11
	1/2" (12.7mm) Cermet 10-Turn Sealed Trimmer	
	3/4" (19.05mm) DIP Cermet 20-Turn Sealed Trimmer	
3214	4mm SMT Cermet Multiturn Sealed Trimmer	12
	4mm SMT Cermet Multiturn Sealed Trimmer	
3250	1/2" (12.7mm) Wirewound 25-Turn Sealed Trimmer	16
3252	1/2" (12.7mm) Cermet 25-Turn Sealed Trimmer	17
	1/4" (6.35mm) Wirewound 11-Turn Sealed Trimmer	
	1/4" (6.35mm) Cermet 12-Turn Sealed Trimmer	
	1.4" (6.35mm) Cermet Multiturn Sealed Trimmer	
	SMT 1/4" (6.35mm) Cermet 12-Turn Sealed Trimmer	
	SMT 3/8" (9.53mm) Cermet 12-Turn Sealed Trimmer	
3290	3/8" (9.53mm) Wirewound 25-Turn Sealed Trimmer	21
	378" (9.53mm) Cermet 25-Turn Sealed Trimmer	
	3/8" (9.53mm) Cermet 25-Turn Sealed Trimmer	
	3/8" (9.53mm) Cermet 25-Turn Sealed Offset Adjustment Trimmer	
	3/8" (9.53mm) Leaded Cermet Multiturn Trimmer	
	3/8" (9.53mm) Cermet 25-Turn Sealed Trimmer	
	2mm SMT Cermet Open Frame Single-Turn Trimmer	
	3mm SMT Cermet Open Frame Single-Turn Trimmer	
	4mm SMT Cermet Open Frame Single-Turn Trimmer	
	6mm Cermet Single-Turn Open Style Trimmer	
	9mm Cermet Single-Turn Open Style Trimmer	
	9mm Square Sealed Conductive Plastic Panel Control	
3313	3mm SMT Cermet Single-Turn Sealed Trimmer	36



Model	Description	Page
3314	4mm SMT Cermet Single-Turn Sealed Trimmer	37
3315	9mm Square Sealed Bushing Mount/PC Board Encoder	177
3316	6mm Carbon Single-Turn Open Style Trimmer	58
3318	6mm Leaded Cermet Open Frame Single-Turn Trimmer	39
3319	9mm Carbon Single-Turn Open Style Trimmer	40
3323	1/4" (6.35mm) Cermet Single-Turn Sealed Trimmer	58
3324	4mm SMT Cermet Sealed Single-Turn Trimmer	42
3325	1/4" (6.35mm) SMT Cermet Single-Turn Sealed Trimmer	58
3329	1/4" (6.35mm) Cermet Single-Turn Sealed Trimmer	44
3335	1/5" (5.08mm) SMT Cermet Single-Turn Sealed Trimmer	58
3339	5/16" (7.93mm) Cermet 4-Turn Sealed Trimmer	45
3345	1/2" (12.7mm) Wirewound Single-Turn Sealed Trimmer	58
3352	3/8" (9.53mm) Cermet Single-Turn Open Style Trimmer	46
3359/VA05	5*3/8" (9.53mm) Cermet Single-Turn Open Style Trimmer	58
3362	1/4" (6.35mm) Cermet Single-Turn Sealed Trimmer	47
3363	3mm SMT Cermet Single-Turn Open Style Trimmer	58
3364	4mm SMT Cermet Open Frame Single-Turn Trimmer	49
3370	6mm Square Sealed Conductive Plastic Panel Control	231
3373	3mm SMT Cermet Sealed Single-Turn Trimmer	52
3374	4mm SMT Cermet Single-Turn Sealed (5-Turn) Trimmer	53
3375	6mm Square Sealed Bushing Mount/PC Board Encoder	174
3386	3/8" (9.53mm) Cermet Single-Turn Sealed Trimmer	54
3386-HV2	3/8" (9.53mm) Cermet Single-Turn Sealed Trimmer	56
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BOURNS, INC. LIFE SUPPORT AND NUCLEAR FACILITY APPLICATIONS POLICY

As a general policy Bourns, Inc. does not recommend the use of any of its products in (a) life support applications where failure or malfunction of the Bourns product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness or (b) any nuclear facility applications. Bourns, Inc. will not knowingly sell its products for use in such applications unless it receives in writing assurances satisfactory to Bourns that (a) the risks of injury or damage have been minimized, (b) the customer assumes all such risks, and (c) the liability of Bourns is protected under the circumstances.

Examples of devices considered to be life support are neonatal oxygen analyzers, nerve stimulators (whether used for anesthesia, pain relief, or other purposes), autotransfusion devices, blood pumps, defibrillators arrhythmia detectors and alarms, pacemakers, hemodialysis systems, peritoneal dialysis systems, neonatal ventilator incubators, ventilators for both adults and infants, anesthesia ventilators, and infusion pumps, as well as other devices designated as "critical" by the FDA.

Examples of nuclear facility applications are applications in (a) a nuclear reactor or (b) any device designated or used in connections with the handling, processing, packaging, preparations, utilization, fabricating, alloying, storing, or disposal of fissionable material or waste products thereof.